CALCULATION OF PUFF STATISTICS FROM ENSEMBLES OF INDIVIDUAL TRAJECTORIES:

FINAL REPORT

CSC 110.J271.02WP

Prepared for

THE ONTARIO MINISTRY OF THE ENVIRONMENT

Prepared by

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September 1983

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SUMMARY OF PROJECT

The Ontario Ministry of the Environment (OME) awarded a contract to Concord Scientific Corporation to calculate puff statistics from ensembles of individual trajectories for use in the OME Statistical Long Range Transport (LRT) Model.

The first phase of the work program consisted of examination of several coordinate systems and methods for computing the trajectory statistics such that distortions due to projecting a spherical surface (the surface of the Earth) onto a plane would be minimized. A method and a coordinate system which would potentially meet these objectives were developed, but could not be fully tested due to time and funding constraints. It was decided to compute the statistics in the OME modified CMC grid coordinates due to practical considerations. The first part of the work program was reported in an interim report CSC 110.J271.01WP.

The second phase of the work program consisted of generating trajectories using the OME Lagrangian Trajectory Model and the data for all 12 months of 1978, 1979, and 1980, and January and July of 1982. These trajectories were then used for calculating the statistical parameters to be used in the Statistical Model. Samples of the resulting statistics for 1978 - 80 have been reported in the main text of the Final Report.

Two sets of trajectories and their statistics were generated for 1982, namely for surface and 850 mb levels, for the purpose of comparing the performance of the Lagrangian Model for these two levels. At the same time, a thorough examination of parts of the Lagrangian Model Code was made for the purpose of providing an independent review. No significant problems were found as a result of this examination and comparison. It was found that in some cases 850 mb trajectories move farther away than the surface trajectories and in a more intuitively expected direction. This part of the work program is reported on in an ADDENDUM to the Final Report.

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1. INTRODUCTION

The Final Report describes in Section 2 the data used in generating the trajectories using the OME Lagrangian Model and in Section 3, the formulae used in calculating the statistics.

In Section 4 sample results for the years 1978-80 are presented. Throughout the report emphasis is given to the theory and codes developed particularly for this project. The complete set of results are stored in data files on the OME's computer system. These files are described in the SPECTRUM documentation which have been provided as part of the final deliverables for this contract. Based on the examination of the sample results as well as the work reported in the ADDENDUM, recommendations are given in Section 5.

2. TRAJECTORY GENERATION AND MASS BUDGET CALCULATION

Trajectories have been generated using the OME Lagrangian Model, which uses time series of surface pressure data as input. These surface pressures are first fitted to 10th degree polynominals. The model then calculates wind fields and corresponding trajectories originating from selected source points. A more complete description of the model is given by Ellenton et al. (1982) and also in the ADDENDUM of this report.

For this project, surface pressure data were sorted and fitted to polynominals, and trajectories were generated every three hours for the first twelve hours after release, and every six hours until ninety-six hours from release (or until loss of the trajectory either due to the domain boundary or other computational reasons). For this work, computer codes which were developed by the Ministry were used. Trajectories from sixty sources designated by the Ministry were generated for a period of three years (1978-80). These sources are listed in Table 2.1 and shown in Figure 2.1. Individual trajectories for the months of January 1978 and July 1978 for Sudbury, Ontario, and for CONMJO ALLEG near Pittsburg, Pennsylvania, are plotted in Figures 2.2 - 2.5. The extent of dispersion of trajectories is evident from these figures. In Figure 2.6, trajectories for January 1980 for Sudbury are plotted, but only until each trajectory reaches the shore. A comparison with Figure 2.2 indicates how loss of trajectories due to a boundary would affect

the mean location of trajectory end points. In Figure 2.6, the earlier loss of trajectories in the east would bias their mean location towards west.

Trajectory statistics for only three of the sixty sources have been reported here in detail as sample results. The complete set of results are stored on the Ministry's computer system.

Once the trajectories are generated using the kinematic trajectory module of the model, they are then weighted according to how much pollutant they carry at any given time using the mass budget calculation module of the model. This module takes into account the wet and dry deposition and chemical transformation of a given pollutant, and requires a time series gridded precipitation data. For this project, the precipitation data supplied by the Ministry have been sorted and gridded using the Ministry's computer codes.

All the data files generated during the course of the above work have been delivered to the Ministry earlier, as each data file was created and finalized.

The trajectory end-points calculated by the Lagrangian Model are given in OME modified CMC coordinates. A description of this coordinate system can be found in Alp and Moran (1983). The weight associated with each trajectory end-point given by the mass budget calculation module is given as a concentration of the pollutant in $\mu g/m^3$.

Table 2.1 The Source Points Used in the Project.
The coordinates are given in OME modified CMC coordinates.

	XOME	YOME		
1	25.79	15.56	ONT	SUDBURY
2	26.11	14.62	ONT	LAKEV TORONTO
3	25.04	16.07	ONT	WAWA
4	24.10	16.29	ONT	THUNDER BAY
5	26.20	16.11	QUE	NORANDA
6	28.92	16.70	QUE	GASPE MURDOCH
7	27.44	15.36	QUE	MONTREAL
8	29.06	16.09	NBR	EAST
9	29.77	15.90	NSC	NORTH
10	30.38	17.18	NFL	WEST
11	23.05	18.84	MAN	THOMPSON
12	22.68	17.15	MAN	WINNIPEG
13	21.20	18.43	SAS	SASKATOON
14	25.39	13.09	OHI	GAVIN GALLIA
15	25.65	14.01	OHI	EASTL CUYAHO
16	24.03	13.07	IND	GIBSON PIKE
17	24.74	13.21	IND	TANNERS CR
18	25.18	14.11	MIC	MONRED MUNROE
19	24.56	14.55	MIC	CAMPBELL KALZ
20	23.41	13.11	ILL	BALDWIN
21	24.10	14.25	ILL	WAUKEGAN
22	23.63	12.68	KEN	SHAWNEE
23	24.36	12.90	KEN	MILL CR JEFF
24	24.24	12.32	TEN	GALLATIN
25	25.27	12.31	TEN	JOHN SEVIER
26	23.14	12.04	TEN	ALLEN
27	25.90	13.37	WVA	HARRISON
28	26.16	13.65	PEN	COMMJO ALLENG
29	27.19	13.78	PEN	MARTINS CR
30	27.65	13.86	NYK	NORTHPT QUEENS
31	26.22	14.36	NYK	DUNKIRK ERIE
32	27.48	14.40	NYK	ALBANY ALBANY
33	28.15	14.19	MAS	BRAY PT MYST
34	28.44	14.98	MNE	YMAN STEAM
35	26.80	13.00	MLD	MORGANT BALT
36	26.65	12.60	VRG	CHESTRFLD 1
37	25.93	12.25	NCA	BELEWS CR
38	26.58	11.53	NCA	SUTTON
39	25.81	11.35	SCA	WATEREE
40	24.58	11.52	GRA	BOWEN
41	24.74	10.56	GRA	MITCHELL
42	25.16	9.43	FLA	BIG BEND HILL
43	24.05	11.27	ALA	GASTON JEFFER
44	23.77	11.83	ALA	COLBERT
45	23.18	10.41	MIS	WATSON
46	21.86	10.54	LOU	CALCASIEU
47	22.32	11.53	ARK	UNION
48	22.83	13.61	MSR	HILL
49	22.10	13.04	MSR	ASBURY
50	22.12	14.79	IOW	GEORGE NEAL
51	23.42	14.29	IOW	KAPP
52	24.18	15.03	WIS	PULLIAM
53	23.14	15.08	MIN	SILVER L
54	23.12	16.14	MIN	CLAYBOSWELL
55	21.64	12.79	OKL	AQCR 186
56	22.35	15.69	SDK	BIG STONE
57	21.57	16.60	NDK	LELAND OLDS
58	21.00	14.77	NBR	AQCR 146
59	20.90	10.45	TEX	AQCR 216
60	21.12	11.44	TEX	AQCR 002

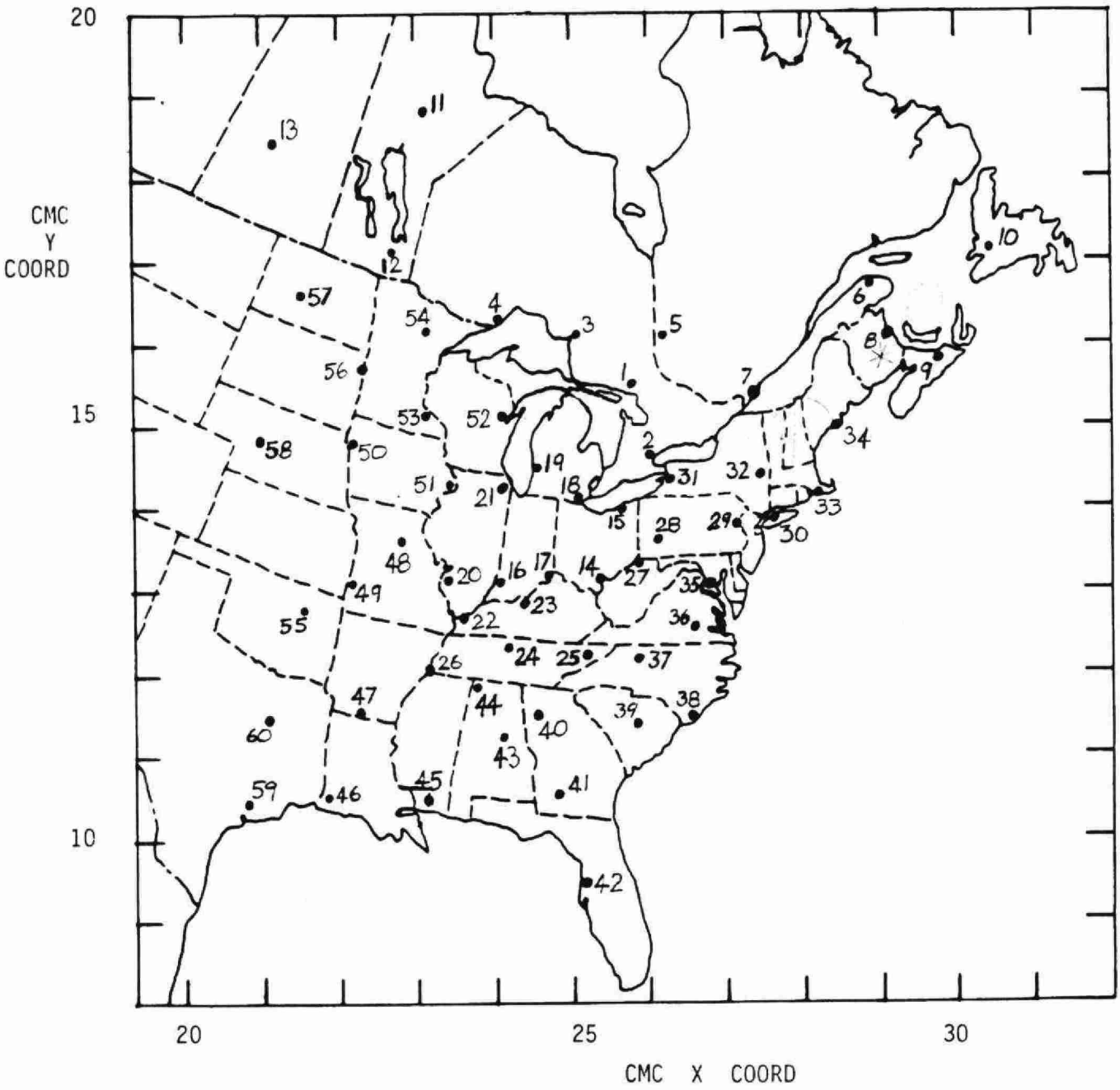

Figure 2.1 The Source Points Used in the Project

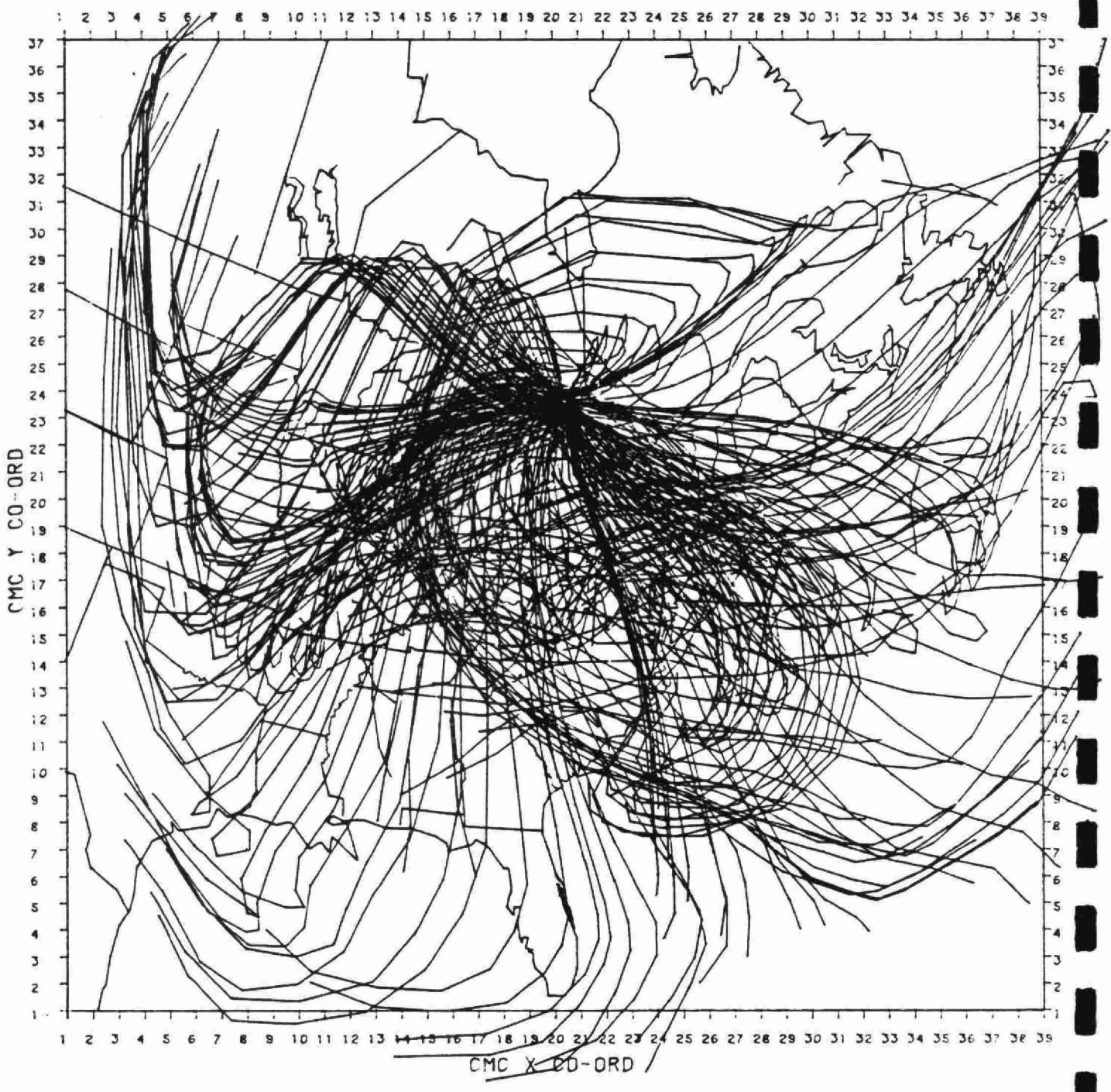

Figure 2.2: Individual trajectories for January 1978 initiated at Sudbury, Ontario.

SOURCE STATION: SUDBURY ONT

DATA: JUL 1978

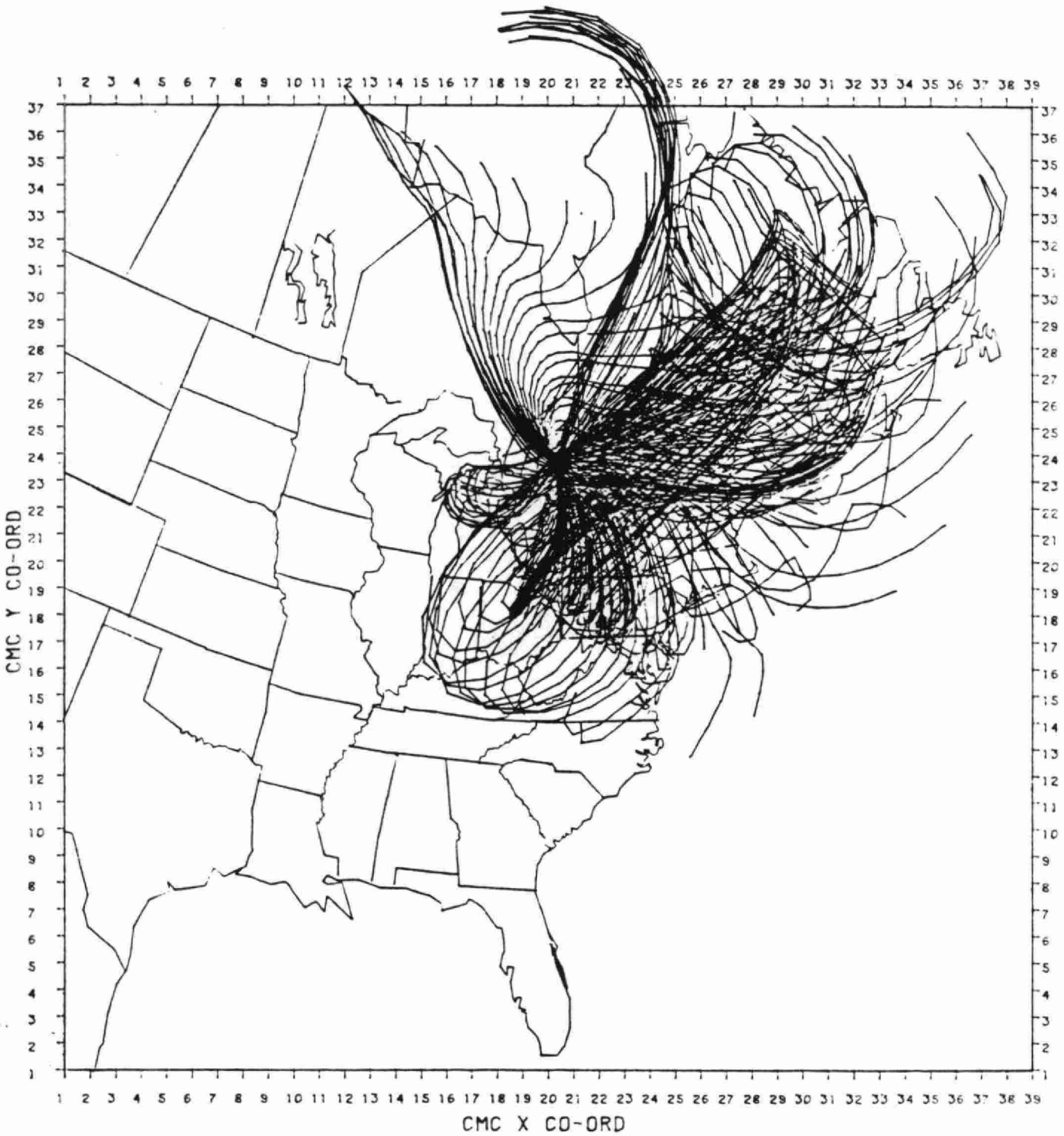

Figure 2.3: Individual Trajectories for July 1978 initiated at Sudbury, Ontario

SOURCE STATION: CONMJO PENN

DATE: JAN 1978

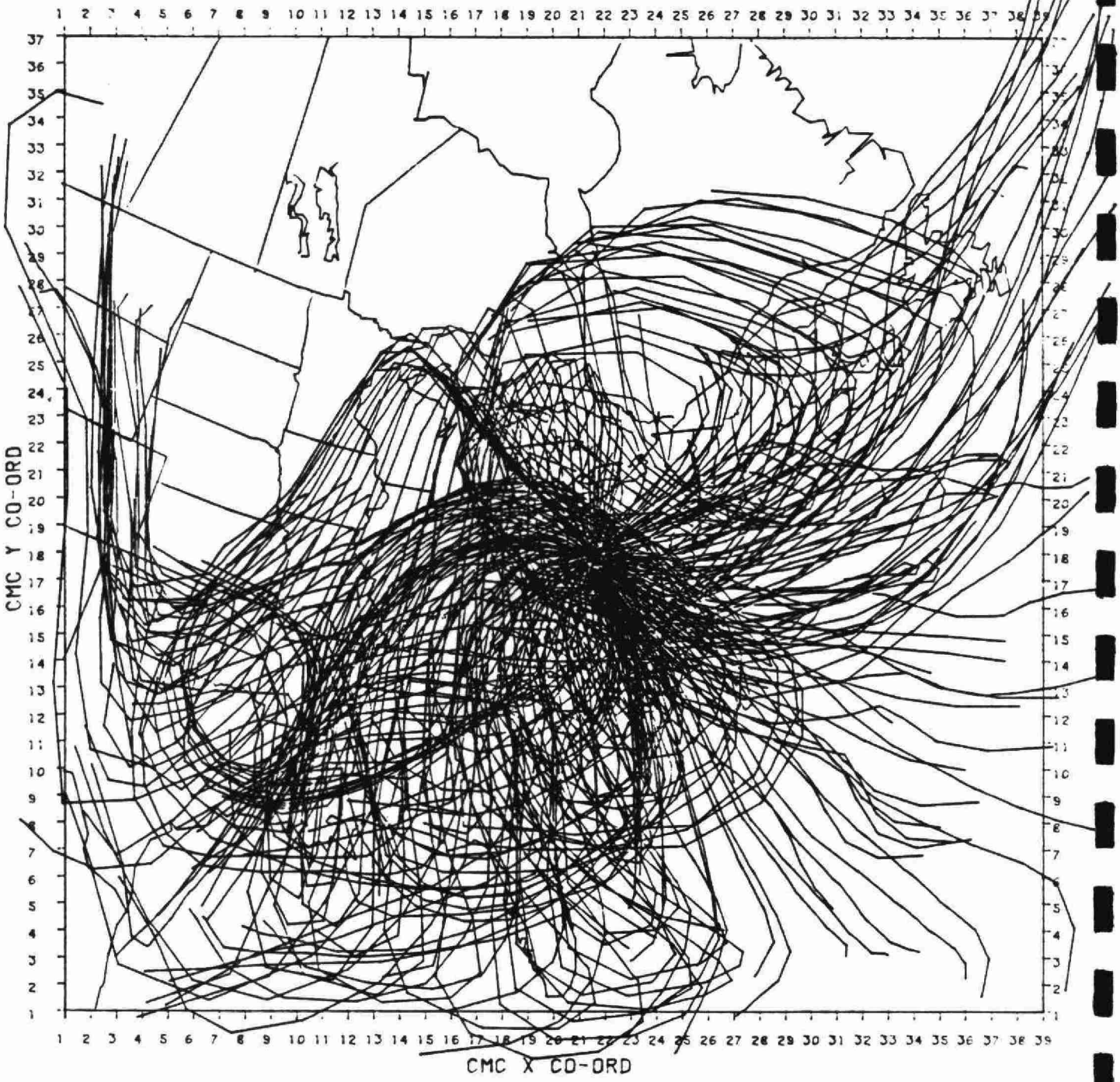

Figure 2.4: Individual trajectories for January 1978 initiated at CONMJO ALLEG near Pittsburgh, Pennsylvania

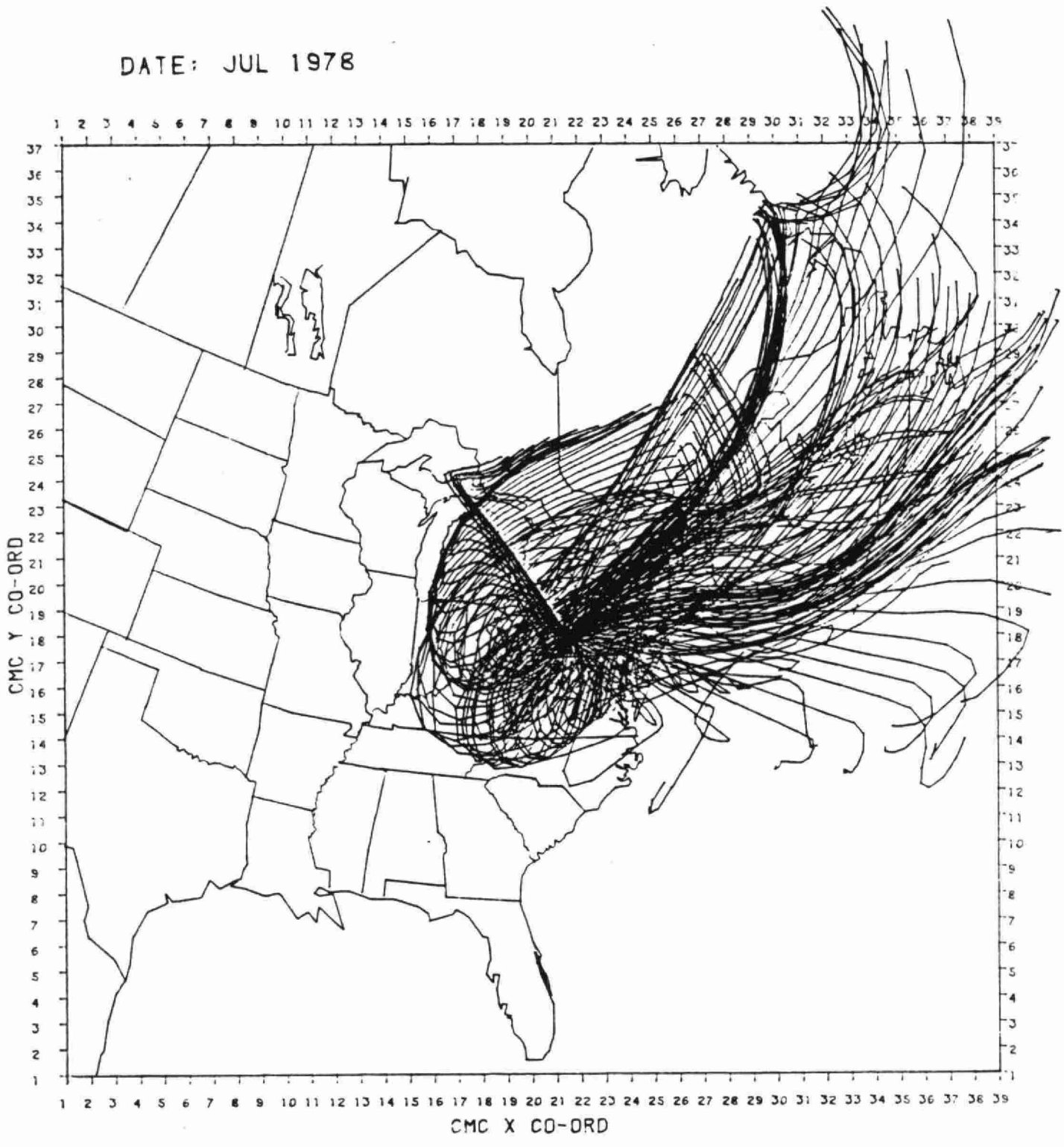

Figure 2.5: Individual trajectories for July 1978 initiated at CONMJO ALLEG near Pittsburgh, Pennsylvania.

Figure 2.6: Individual trajectories for January 1980 initiated at Sudbury, Ontario. These trajectories have not been continued beyond the shore.

3. ESTIMATION OF STATISTICS

The main objective of this project was to estimate the first- and second-order moments of the x and y coordinates of points in trajectories generated by the Ministry's Lagrangian Long Range Trajectory Model. These statistics were to be estimated at discrete travel-times from ensembles of trajectories from the same source that have been initiated at different times.

Before writing the mathematical formulae that were used, which may look unfamiliar at first glance, the formulae for the estimates of mean $\bar{x}$ of n observations x_i, the standard deviation σ_x, and the covariance σ_{xy} of two random variables (x and y) are written below:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} ,$$

$$\sigma_x = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}} ,$$

and

$$\sigma_{xy} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{n} .$$

Note that σ_x^2 is the biased estimator of the variance rather than the unbiased estimator

$$s^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}$$

which tends to be used more frequently.

For the statistics to be estimated, it was required to compute the means, standard deviations and the covariance of the coordinates of trajectory points. It was also required to calculate mass-depletion weighted statistics (or "decaying puff" statistics) for sulphur dioxide and sulphate. This is done by using species concentrations at each point in the trajectory as a weighting function.

To clearly state the formulae for the statistics, let us carefully define the terms that will be represented. At a time-step t from a source k, the statistics to be estimated are:

a) the mean of the x-coordinates of the points, which is represented by $\bar{x}$ (k,t),
b) the mean of the y-coordinates of the points, which is represented by $\bar{y}$ (k,t),
c) the standard deviation of the x-coordinates, which is represented by σ_{xy} (k,t),
d) the standard deviation of the y-coordinate, which is represented by σ_y(k,t), and
e) the covariance of x- and y-coordinates, which is represented by σ_{xy}(k,t).

We suppose that N(k,o) trajectories are initiated from source k, and that an integer from 1 to N will be assigned to uniquely represent the time each trajectory is initiated. The x-coordinate of the point at time t from the i-th trajectory initiated from source k is denoted by $x_i(k,t)$, i=1,2,...,N(k,t). We define $y_i(k,t)$ similarly. To denote the weight assigned to the point of the i-th trajectory for source k at travel-time t we use $w_i(k,t)$. This weighting variable $w_i(k,t)$ is useful in the unweighted case as well. We define $w_i(k,t)$ to be a binary weighting function in the unweighted case. That is, either $w_i(k,t) = 1$, or $w_i(k,t) = 0$. Since trajectories can be terminated prematurely and not reach the full anticipated lifetime, in the unweighted case where t^* is the first time step where there is no point, then we set $w_i(k,t) = 0$ for all $t>t^*$. In the cases where a species concentration is used as a weighting function, we similarly set $w_i(k,t) =$ for $t>t^*$ (this is reasonable since if there is no point, one cannot calculate a species concentration). Let W(k,t) denote the accumulated weight from all trajectories that are initiated at source k after a travel time t. The formulae for estimating the statistics are as follows:

$$W(k,t) = \sum_{i=1}^{N} w_i(k,t)$$

$$\bar{x}(k,t) = \frac{1}{W(k,t)} \sum_{i=1}^{N} x_i(k,t)w_i(k,t)$$

$$\bar{y}(k,t) = \frac{1}{W(k,t)} \sum_{i=1}^{N} y_i(k,t)w_i(k,t)$$

$$\sigma_x(k,t) = \sqrt{\frac{1}{W(k,t)} \sum_{i=1}^{N} [x_i(k,t)-\bar{x}(k,t)]^2 w_i(k,t)}$$

$$\sigma_y(k,t) = \sqrt{\frac{1}{W(k,t)} \sum_{i=1}^{N} [y_i(k,t)-\bar{y}(k,t)]^2 w_i(k,t)}$$

and

$$\sigma_{xy}(k,t) = \frac{1}{W(k,t)} \sum_{i=1}^{N} [x_i(k,t)-\bar{x}(k,t)][y_i(k,t)-\bar{y}(k,t)] w_i(k,t)$$

These six equations are those used in the unweighted, sulphur dioxide weighted, and sulphate weighted cases.

Five more statistics have been calculated for various initiation periods and sources, but these additional statistics are derived from the preceeding six. The percentage of initial concentration remaining is given by:

$$a(k,t) = \frac{W(k,t)}{W(k,o)} \times 100.$$

The interpretation of a(k,t) in the unweighted case is the percentage of trajectories surviving at travel time t that were initiated from source k. The mean concentration is given by:

$$b(k,t) = \frac{W(k,t)}{N(k,t)},$$

where N(k,t) is the number of trajectories surviving at travel time t that were generated from source k. That is, N(k,t) is equal to W(k,t) of the unweighted case. There is no point in reporting b(k,t) for the unweighted case since it is identically equal to one except when there are no trajectories and then there are no statistics at all. The standard error of the x-coordinate is

$$\sigma_{\bar{x}}(k,t) = \frac{\sigma_x(k,t)}{\sqrt{W(k,t)}}$$

and correspondingly, the standard error of the y-coordinate is

$$\sigma_{\bar{y}}(k,t) = \frac{\sigma_y(k,t)}{\sqrt{W(k,t)}}$$

It might need to be pointed out that the standard error is an expression of the variability of the mean, whereas, the standard deviation is an expression of the variability of a single observation.

If one assumes that the points in the ensemble of trajectories N(k,t) are distributed according to the bivariate normal (or Gaussian) distribution, then standard statistical analysis leads us to the estimate $\Theta(k,t)$ of the orientation of the major-axis of the probability ellipse with the x-axis that is given by

$$\Theta(k,t) = \arctan\left[\frac{\sigma_{xy}(k,t)}{\sigma_x^2(k,t)}\right]$$

where Θ is reported in degrees and is constrained such that

$$-90^\circ \leq \Theta(k,t) \leq 90^\circ.$$

A discussion of the estimation of statistics is not complete without documentation of the precision of the floating-point representation of the values that are calculated by the required computer routines. Due to time constraints it was not feasible to perform a thorough and detailed analysis of error resulting from floating-point representation and floating-point arithmetic. Nevertheless, based on established practice and a quick check, we were able to obtain a floating-point representation in which we are confident. The computer routines were written in the FORTRAN language which allows only three different precisions of floating point representation: single precision (REAL*4), double precision (REAL*8), and quadruple precision (REAL*16). For a number represented in scientific notation (for example, 6.735×10^{-5}), single precision would give 7 significant decimal digits for the mantissa, double precision would give 16 significant digits, and quadruple precision would give 35 significant decimal digits for the mantissa.

Tables 3.1, 3.2 and 3.3 contain statistics estimated for the first 10 trajectories in January 1978 that were initiated at Sudbury.

Each table was generated using the same program except Table 3.1, which was obtained using single precision arithmetic, Table 3.2 was obtained using double precision arithmetic, and Table 3.3 was done using quadruple precision arithmetic. These tables were produced by a developmental precursor of the production program and contain a few more statistics not calculated in the production runs. These will now be described for completeness. The correlation coefficient for two random variables is

$$r = \frac{S_{xy}}{S_x S_y}$$

where $$S_x = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})} \quad ,$$

$$S_y = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (y_i - \bar{y})} \quad ,$$

and $$S_{xy} = \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y}) \quad .$$

The measure of skewness used is

$$\beta_1 = \frac{\frac{1}{n} \sum (x_i - \bar{x})^3}{S_x^3} \quad .$$

The measure of kurtosis used is

$$\beta_2 = \frac{\frac{1}{n}\sum (x_i - \bar{x})^4}{s_x^4}$$

Some entries in the tables are error flagging values such as negative standard deviations (to indicate the variance was calculated to be negative - a result of floating-pointing arithmetic error), -11,111 or -88,888 to indicate that a division by zero occurred in calculating the statistic, or -77,777 to indicate a nonpositive variance was produced in the algorithm that estimates the correlation coefficient.

Comparison of the three tables shows discrepancies between single and double precision arithmetic. These discrepancies are significant enough to recommend that single precision not be used. Standard statistical computing practice is not to use single precision, so the recommendation is not a surprise. The comparison of the eight decimal digits in the mantissa for the statistics produced by double precision and quadruple precision show consistency for at least the first and second order moments. This is much better than the single and double precision comparison where at times only one of eight digits are in agreement.

Tables 3.4 and 3.5 list estimates of statistics for all trajectories initiated in January of 1978 from Sudbury for double and quadruple precision, respectively. The values produced by the two precisions for the first and second order moments are identical. The third and four order moments by the two precisions agree to at worst five significant digits.

Therefore, on the basis of this brief analysis, it was decided that double precision would be fully satisfactory for our purposes.

Table 3.1: Estimated statistics for first 10 trajectories for Sudbury. Single precision.

SOURCE STATION IS: 1

ITIME	NO. OF OBS.	XMEAN	XSIGMA	YMEAN	YSIGMA	CORRELATION COEFF.
0	10	0.25789978E+02	0.20833332E-01	0.15559998E+02	0.52083321E-02	-0.77777000E+05
3	10	0.25673584E+02	0.20833332E-01	0.15607252E+02	0.46584748E-01	0.28867507E+00
6	10	0.25553802E+02	0.0	0.15695449E+02	0.85104883E-01	-0.11111000E+05
9	10	0.25429733E+02	0.0	0.15823963E+02	0.11945152E+00	-0.11111000E+05
12	10	0.25304947E+02	-0.20833332E-01	0.15985905E+02	0.14601922E+00	-0.11111000E+05
18	10	0.25074844E+02	0.29462781E-01	0.16363876E+02	0.18812515E+00	0.23907776E+01
24	10	0.24884781E+02	0.88388324E-01	0.16774292E+02	0.14120251E+00	0.70452303E+00
30	10	0.24755661E+02	0.17677671E+00	0.17173813E+02	0.87617755E-01	0.72602689E-01
36	10	0.24695358E+02	0.26679677E+00	0.17525620E+02	0.11327374E+00	-0.87845808E+00
42	10	0.24682861E+02	0.33137441E+00	0.17807053E+02	0.19277871E+00	-0.99292105E+00
48	10	0.24680054E+02	0.37442082E+00	0.18020920E+02	0.27312726E+00	-0.10013113E+01
54	10	0.24662949E+02	0.42542869E+00	0.18180710E+02	0.34295988E+00	-0.99977595E+00
60	10	0.24637299E+02	0.51580906E+00	0.18301880E+02	0.40053403E+00	-0.99561244E+00
66	10	0.24616302E+02	0.63087517E+00	0.18403702E+02	0.44867301E+00	-0.99770486E+00
72	10	0.24609161E+02	0.75144535E+00	0.18519348E+02	0.48961097E+00	-0.10001965E+01
78	10	0.24606155E+02	0.86927694E+00	0.18691116E+02	0.51709592E+00	-0.10000362E+01
84	10	0.24579468E+02	0.98821175E+00	0.18941467E+02	0.53650892E+00	-0.99871141E+00
90	10	0.24475204E+02	0.11006231E+01	0.19251266E+02	0.56569785E+00	-0.99926418E+00
96	10	0.24246719E+02	0.12281065E+01	0.19542023E+02	0.57969475E+00	-0.99357635E+00

TIME	NO. OF OBS.	XSKEW	XKURT	YSKEW	YKURT	COVARIANCE
0	10	0.20736011E+04	-0.65691660E+07	0.14515211E+05	0.71132864E+08	0.43945294E-03
3	10	-0.12096003E+04	0.32514070E+07	0.28979445E+01	-0.11778051E+05	0.34179678E-03
6	10	-0.11111000E+05	-0.11111000E+05	0.52281809E+01	-0.67016968E+03	-0.24414054E-04
9	10	-0.11111000E+05	-0.11111000E+05	-0.24837318E+01	0.66768628E+03	-0.17089843E-03
12	10	-0.22222000E+05	-0.22222000E+05	0.19761066E+01	-0.34770041E+01	-0.43945294E-03
18	10	-0.73312866E+03	0.15261700E+07	-0.16439629E+01	0.15645143E+03	0.27343750E-02
24	10	0.18101944E+02	-0.73728086E+04	-0.61049967E+01	0.91188135E+03	0.82031228E-02
30	10	0.62225399E+01	-0.14463997E+04	-0.16260788E+02	0.46662070E+04	0.15624999E-02
36	10	0.10696011E+01	-0.61677719E+02	-0.11825650E+02	0.16703821E+04	-0.22656247E-01
42	10	0.25764066E+00	-0.33172958E+02	0.21809357E+00	0.99555771E+02	-0.56640625E-01
48	10	0.29767352E+00	-0.12720385E+01	-0.10736256E+01	0.44926179E+02	-0.91015577E-01
54	10	0.68995190E+00	-0.37396332E+02	-0.38733816E+00	0.12649254E+02	-0.13085937E+00
60	10	0.36433697E+00	-0.14126816E+01	-0.41338116E+00	0.14084799E+02	-0.18359375E+00
66	10	0.32358831E+00	0.78910786E+00	-0.38058621E+00	0.74028950E+01	-0.25273436E+00
72	10	0.29827219E+00	-0.30186386E+01	-0.23962897E+00	0.41329403E+01	-0.33007812E+00
78	10	0.21646458E+00	0.26269913E+01	-0.20341325E+00	0.34966774E+01	-0.40351558E+00
84	10	0.24610102E+00	0.24903679E+01	-0.19223958E+00	0.21121778E+01	-0.47617185E+00
90	10	0.30821967E+00	0.18229294E+01	-0.35387528E+00	0.69573994E+01	-0.55859375E+00
96	10	0.40659225E+00	0.13462696E+01	-0.35926012E+00	0.78590698E+01	-0.63515621E+00

Table 3.2: Estimated statistics for first 10 trajectories for Sudbury. Double precision.

SOURCE STATION IS: 1

ITIME	NO. OF OBS.	XMEAN	XSIGMA	YMEAN	YSIGMA	CORRELATION COEFF.
0	10	0.25789993D+02	0.0	0.15560000D+02	0.0	-0.88888000D+05
3	10	0.25673604D+02	0.54003135D-02	0.15607259D+02	0.44987752D-01	0.44934838D-02
6	10	0.25553807D+02	0.97764989D-02	0.15695494D+02	0.84398667D-01	-0.10814330D+00
9	10	0.25429735D+02	0.13040523D-01	0.15823972D+02	0.11858300D+00	-0.24108323D+00
12	10	0.25304953D+02	0.13416039D-01	0.15985908D+02	0.14598351D+00	-0.26927332D+00
18	10	0.25074857D+02	0.23140284D-01	0.16363876D+02	0.16829874D+00	0.74001928D+00
24	10	0.24884789D+02	0.88186791D-01	0.16774306D+02	0.13968351D+00	0.67231241D+00
30	10	0.24755666D+02	0.17888398D+00	0.17173824D+02	0.86072754D-01	0.10041010D+00
36	10	0.24695361D+02	0.26774581D+00	0.17525633D+02	0.11152824D+00	-0.85760055D+00
42	10	0.24682870D+02	0.33144404D+00	0.17807053D+02	0.19313635D+00	-0.98359232D+00
48	10	0.24680061D+02	0.37418321D+00	0.18020930D+02	0.27255686D+00	-0.99529517D+00
54	10	0.24662952D+02	0.42622563D+00	0.18180714D+02	0.34292641D+00	-0.99479403D+00
60	10	0.24637311D+02	0.51546923D+00	0.18301894D+02	0.39997500D+00	-0.99196688D+00
66	10	0.24616315D+02	0.63095654D+00	0.18403716D+02	0.44814470D+00	-0.99478671D+00
72	10	0.24609166D+02	0.75163623D+00	0.18519359D+02	0.48931057D+00	-0.99807560D+00
78	10	0.24606168D+02	0.86898886D+00	0.18691124D+02	0.51693241D+00	-0.99800581D+00
84	10	0.24579472D+02	0.98805750D+00	0.18941469D+02	0.53655541D+00	-0.99755796D+00
90	10	0.24475215D+02	0.11005764D+01	0.19251280D+02	0.56527733D+00	-0.99782975D+00
96	10	0.24246729D+02	0.12280171D+01	0.19542036D+02	0.57927492D+00	-0.99243744D+00

TIME	NO. OF OBS.	XSKEW	XKURT	YSKEW	YKURT	COVARIANCE
0	10	-0.11111000D+05	-0.11111000D+05	-0.11111000D+05	-0.11111000D+05	0.0
3	10	-0.77737327D+00	0.26554368D+01	-0.37039537D+00	0.17551813D+01	0.98251456D-06
6	10	-0.52405527D+00	0.16820955D+01	-0.36168716D+00	0.19446320D+01	-0.80308418D-04
9	10	-0.25399340D+00	0.12648422D+01	-0.20578507D+00	0.20856442D+01	-0.33552660D-03
12	10	0.73580526D-02	0.13022702D+01	0.11753931D-01	0.20156876D+01	-0.47463958D-03
18	10	0.55999204D+00	0.22632552D+01	-0.11665150D+00	0.17361661D+01	0.25937916D-02
24	10	0.83306696D+00	0.21771967D+01	-0.79176859D+00	0.22624544D+01	0.74535352D-02
30	10	0.56867235D+00	0.17185587D+01	-0.12074871D+01	0.35961909D+01	0.13914162D-02
36	10	0.36778921D+00	0.15048103D+01	-0.12217494D+00	0.13945950D+01	-0.23048098D-01
42	10	0.24833164D+00	0.14156966D+01	-0.21119634D+00	0.12655171D+01	-0.56667217D-01
48	10	0.21543545D+00	0.14006253D+01	-0.15763050D+00	0.12988064D+01	-0.91355738D-01
54	10	0.25796413D+00	0.14330532D+01	-0.12750589D+00	0.13170707D+01	-0.13086279D+00
60	10	0.31093770D+00	0.14530402D+01	-0.10090574D+00	0.13241775D+01	-0.18406672D+00
66	10	0.28558908D+00	0.14070150D+01	-0.12331082D+00	0.13546776D+01	-0.25315715D+00
72	10	0.25194498D+00	0.13806471D+01	-0.14866551D+00	0.13296551D+01	-0.33036821D+00
78	10	0.24726661D+00	0.13688835D+01	-0.13376909D+00	0.12665440D+01	-0.40348143D+00
84	10	0.26449471D+00	0.13632010D+01	-0.14468950D+00	0.12627565D+01	-0.47596766D+00
90	10	0.31998333D+00	0.13906665D+01	-0.21880710D+00	0.13641117D+01	-0.55870263D+00
96	10	0.40303421D+00	0.14343695D+01	-0.26540013D+00	0.14928451D+01	-0.63538194D+00

Table 3.3: Estimated statistics for first 10 trajectories for Sudbury. Quadruple precision.

SOURCE STATION IS: 1

ITIME	NO. OF OBS.	XMEAN	XSIGMA	YMEAN	YSIGMA	CORRELATION COEFF.
0	10	0.257899930+02	0.0	0.155600000+02	0.0	-0.888880000+05
3	10	0.256736040+02	0.540031350-02	0.156072590+02	0.449877520-01	0.449349380-02
6	10	0.255538070+02	0.977649890-02	0.156954940+02	0.843986670-01	-0.108143300+00
9	10	0.254297350+02	0.130405230-01	0.158239720+02	0.118583000+00	-0.241083230+00
12	10	0.253049530+02	0.134160390-01	0.159859080+02	0.145983510+00	-0.269273320+00
18	10	0.250748570+02	0.231402840-01	0.163638760+02	0.168298740+00	0.740019280+00
24	10	0.248847890+02	0.881867910-01	0.167743060+02	0.139683510+00	0.672312410+00
30	10	0.247556660+02	0.178883980+00	0.171738240+02	0.860727540-01	0.100410100+00
36	10	0.246953610+02	0.267745810+00	0.175256330+02	0.111528240+00	-0.857600550+00
42	10	0.246828700+02	0.331444040+00	0.178070530+02	0.193136350+00	-0.983592320+00
48	10	0.246800610+02	0.374183210+00	0.180209300+02	0.272556860+00	-0.995295170+00
54	10	0.246629520+02	0.426225630+00	0.181807140+02	0.342926410+00	-0.994794030+00
60	10	0.246373110+02	0.515469230+00	0.183018940+02	0.399975000+00	-0.991966880+00
66	10	0.246163150+02	0.630956540+00	0.184037160+02	0.448144700+00	-0.994786710+00
72	10	0.246091660+02	0.751636230+00	0.185193590+02	0.489310570+00	-0.998075600+00
78	10	0.246061680+02	0.868988860+00	0.186911240+02	0.516932410+00	-0.998005810+00
84	10	0.245794720+02	0.988057500+00	0.189414690+02	0.536555410+00	-0.997557960+00
90	10	0.244752150+02	0.110057640+01	0.192512800+02	0.565277330+00	-0.997829750+00
96	10	0.242467290+02	0.122801710+01	0.195420360+02	0.579274920+00	-0.992437440+00

TIME	NO. OF OBS.	XSKEW	XKURT	YSKEW	YKURT	COVARIANCE
0	10	-0.111110000+05	-0.111110000+05	-0.111110000+05	-0.111110000+05	0.0
3	10	-0.777303560+00	0.188469000+01	-0.370395370+00	0.175516880+01	0.982514470-06
6	10	-0.524040700+00	0.160653280+01	-0.361687170+00	0.194463150+01	-0.803084180-04
9	10	-0.253987450+00	0.124542120+01	-0.205785070+00	0.208564400+01	-0.335526600-03
12	10	0.736130520-02	0.129266690+01	0.117539310-01	0.201568750+01	-0.474639580-03
18	10	0.559993130+00	0.226170330+01	-0.116651500+00	0.173616600+01	0.259379160-02
24	10	0.833066970+00	0.217719590+01	-0.791768590+00	0.226245430+01	0.745353520-02
30	10	0.568672350+00	0.171855820+01	-0.120748710+01	0.359618990+01	0.139141620-02
36	10	0.367789210+00	0.150481020+01	-0.122174940+00	0.139459450+01	-0.230480980-01
42	10	0.248331640+00	0.141569660+01	-0.211196340+00	0.126551710+01	-0.566672170-01
48	10	0.215435450+00	0.140062530+01	-0.157630500+00	0.129880640+01	-0.913557380-01
54	10	0.257964130+00	0.143305320+01	-0.127505890+00	0.131707070+01	-0.130862790+00
60	10	0.310937700+00	0.145304020+01	-0.100905740+00	0.132417740+01	-0.184066720+00
66	10	0.285589080+00	0.140701500+01	-0.123310820+00	0.135467760+01	-0.253157150+00
72	10	0.251944980+00	0.138064710+01	-0.148665510+00	0.132965510+01	-0.330368210+00
78	10	0.247266610+00	0.136488350+01	-0.133769090+00	0.126654400+01	-0.403481430+00
84	10	0.264494710+00	0.136320100+01	-0.144689500+00	0.126275550+01	-0.475967660+00
90	10	0.319983330+00	0.139056650+01	-0.218907100+00	0.130411170+01	-0.558702630+00
96	10	0.403034210+00	0.143436850+01	-0.265400130+00	0.149284510+01	-0.635381840+00

Table 3.4: Estimates of statistics for trajectories for Sudbury. January 1978. Double precision.

SOURCE STATION IS: 1

ITIME	NO. OF OBS.	XMEAN	XSIGMA	YMEAN	YSIGMA	CORRELATION COEFF.
0	248	0.25789993D+02	0.0	0.15560000D+02	0.0	-0.88888000D+05
3	248	0.25871383D+02	0.11053769D+00	0.15558405D+02	0.12709147D+00	0.29320117D+00
6	248	0.25951157D+02	0.21938408D+00	0.15558931D+02	0.25363127D+00	0.30121092D+00
9	248	0.26028405D+02	0.32556138D+00	0.15561853D+02	0.37834791D+00	0.31056710D+00
12	248	0.26101712D+02	0.42701195D+00	0.15567185D+02	0.49451062D+00	0.32001773D+00
18	248	0.26237513D+02	0.61271592D+00	0.15584571D+02	0.71875076D+00	0.33815979D+00
24	248	0.26365941D+02	0.78085409D+00	0.15610239D+02	0.91479737D+00	0.35245769D+00
30	248	0.26494575D+02	0.93399043D+00	0.15643660D+02	0.10843791D+01	0.36130874D+00
36	248	0.26628641D+02	0.10722240D+01	0.15684922D+02	0.12254942D+01	0.36449829D+00
42	248	0.26771042D+02	0.11943637D+01	0.15735174D+02	0.13409270D+01	0.36312577D+00
48	248	0.26921964D+02	0.13010014D+01	0.15796274D+02	0.14426907D+01	0.35894185D+00
54	248	0.27076006D+02	0.13926258D+01	0.15868123D+02	0.15415833D+01	0.35139567D+00
60	248	0.27225633D+02	0.14692739D+01	0.15949649D+02	0.16381805D+01	0.33922876D+00
66	248	0.27368777D+02	0.15319910D+01	0.16041798D+02	0.17285514D+01	0.32053475D+00
72	248	0.27508362D+02	0.15848210D+01	0.16146249D+02	0.18116330D+01	0.29110592D+00
78	248	0.27644313D+02	0.16319714D+01	0.16263636D+02	0.18860401D+01	0.24773456D+00
84	248	0.27770359D+02	0.16754474D+01	0.16393936D+02	0.19497786D+01	0.19029214D+00
90	248	0.27880175D+02	0.17175935D+01	0.16538995D+02	0.20001104D+01	0.12201019D+00
96	248	0.27973234D+02	0.17672047D+01	0.16696646D+02	0.20361707D+01	0.50735040D-01

TIME	NO. OF OBS.	XSKEW	XKURT	YSKEW	YKURT	COVARIANCE
0	248	-0.11111000D+05	-0.11111000D+05	-0.11111000D+05	-0.11111000D+05	0.0
3	248	-0.23872568D-01	0.22784159D+01	-0.54254401D+00	0.26533038D+01	0.41023973D-02
6	248	-0.31346443D-01	0.22928336D+01	-0.53425294D+00	0.26312734D+01	0.16692597D-01
9	248	-0.45902647D-01	0.23025958D+01	-0.51734877D+00	0.25935692D+01	0.38099996D-01
12	248	-0.64791035D-01	0.23089272D+01	-0.49125069D+00	0.25445572D+01	0.67847484D-01
18	248	-0.10761289D+00	0.23060550D+01	-0.42716729D+00	0.24311227D+01	0.14832171D+00
24	248	-0.15559576D+00	0.22929595D+01	-0.34703102D+00	0.23173127D+01	0.25075354D+00
30	248	-0.20281558D+00	0.22773961D+01	-0.25591384D+00	0.22166958D+01	0.36445784D+00
36	248	-0.23909782D+00	0.22699820D+01	-0.15835831D+00	0.21399251D+01	0.47702107D+00
42	248	-0.25448842D+00	0.22625268D+01	-0.65914792D-01	0.20948651D+01	0.57922072D+00
48	248	-0.25119127D+00	0.22427657D+01	0.92107970D-02	0.20838511D+01	0.67099667D+00
54	248	-0.24163956D+00	0.22178541D+01	0.66724928D-01	0.21112516D+01	0.75135139D+00
60	248	-0.23638807D+00	0.22042742D+01	0.11818987D+00	0.21873042D+01	0.81320951D+00
66	248	-0.23357913D+00	0.22110695D+01	0.17326705D+00	0.23134489D+01	0.86539147D+00
72	248	-0.22233504D+00	0.22334311D+01	0.22598326D+00	0.24581005D+01	0.89242811D+00
78	248	-0.20597707D+00	0.22536735D+01	0.25820765D+00	0.25643016D+01	0.89444327D+00
84	248	-0.21420848D+00	0.22601100D+01	0.25821786D+00	0.26027712D+01	0.86913051D+00
90	248	-0.27111960D+00	0.23036837D+01	0.23005238D+00	0.25785538D+01	0.81746083D+00
96	248	-0.40195413D+00	0.25007015D+01	0.16634680D+00	0.25123518D+01	0.18164671D+00

Table 3.5: Estimates of statistics for trajectories for Sudbury. January 1978. Quadruple precision.

SOURCE STATION IS: 1

ITIME	NO. OF OBS.	XMEAN	XSIGMA	YMEAN	YSIGMA	CORRELATION COEFF.
0	248	0.257899930+02	0.0	0.155600000+02	0.0	-0.888880000+05
3	248	0.258713830+02	0.110537690+00	0.155584050+02	0.127091470+00	0.293201170+00
6	248	0.259511570+02	0.219384080+00	0.155589310+02	0.253631270+00	0.301210920+00
9	248	0.260284050+02	0.325561380+00	0.155618530+02	0.378347910+00	0.310567100+00
12	248	0.261017120+02	0.427011950+00	0.155671850+02	0.498510620+00	0.320017730+00
18	248	0.262375130+02	0.612715920+00	0.155845710+02	0.718750760+00	0.338159790+00
24	248	0.263659410+02	0.780854090+00	0.156102390+02	0.914797370+00	0.352457690+00
30	248	0.264945750+02	0.933990430+00	0.156436600+02	0.108437910+01	0.361308740+00
36	248	0.266286410+02	0.107222400+01	0.156849220+02	0.122549420+01	0.364499290+00
42	248	0.267710420+02	0.119436370+01	0.157351740+02	0.134092700+01	0.363125770+00
48	248	0.269219640+02	0.130100140+01	0.157962740+02	0.144269070+01	0.358941850+00
54	248	0.270760060+02	0.139262580+01	0.158681230+02	0.154158330+01	0.351395670+00
60	248	0.272256330+02	0.146927390+01	0.159496490+02	0.163818050+01	0.339228760+00
66	248	0.273687770+02	0.153199100+01	0.160417990+02	0.172855140+01	0.320534750+00
72	248	0.275083620+02	0.158482100+01	0.161462490+02	0.181163300+01	0.291105920+00
78	248	0.276443130+02	0.163197140+01	0.162636360+02	0.188604010+01	0.247734560+00
84	248	0.277703590+02	0.167544740+01	0.163939360+02	0.194977860+01	0.190292140+00
90	248	0.278801750+02	0.171759350+01	0.165389950+02	0.200011040+01	0.122010190+00
96	248	0.279732340+02	0.176720470+01	0.166966460+02	0.203417070+01	0.507350400-01

TIME	NO. OF OBS.	XSKEW	XKURT	YSKEW	YKURT	COVARIANCE
0	248	-0.111110000+05	-0.111110000+05	-0.111110000+05	-0.111110000+05	0.0
3	248	-0.238724930-01	0.227835860+01	-0.542544010+00	0.265330250+01	0.410239730-02
6	248	-0.313464340-01	0.229283000+01	-0.534252940+00	0.263127330+01	0.166925970-01
9	248	-0.459026440-01	0.230259500+01	-0.517348770+00	0.259356920+01	0.380999960-01
12	248	-0.647910340-01	0.230892690+01	-0.493250690+00	0.254455720+01	0.678474840-01
18	248	-0.107612890+00	0.230605500+01	-0.427167290+00	0.243112270+01	0.148321710+00
24	248	-0.155595760+00	0.229295940+01	-0.347031020+00	0.231731270+01	0.250753540+00
30	248	-0.202815580+00	0.227739600+01	-0.255913840+00	0.221669580+01	0.364457840+00
36	248	-0.239097820+00	0.226998200+01	-0.158358310+00	0.213992510+01	0.477021070+00
42	248	-0.254488420+00	0.226252680+01	-0.659147920-01	0.209486510+01	0.579220720+00
48	248	-0.251191270+00	0.224276570+01	0.921079700-02	0.208385110+01	0.670996670+00
54	248	-0.241639560+00	0.221785410+01	0.667249280-01	0.211125160+01	0.751351390+00
60	248	-0.236388070+00	0.220427420+01	0.118189870+00	0.218730420+01	0.813209510+00
66	248	-0.233579130+00	0.221106950+01	0.173257050+00	0.231344890+01	0.845393470+00
72	248	-0.222335040+00	0.223343110+01	0.225983260+00	0.245810050+01	0.832428110+00
78	248	-0.205977070+00	0.225367350+01	0.258207650+00	0.256430160+01	0.759443270+00
84	248	-0.214208480+00	0.226011000+01	0.258217860+00	0.260277120+01	0.619130510+00
90	248	-0.277111960+00	0.230368370+01	0.230052380+00	0.257855380+01	0.417460830+00
96	248	-0.401954130+00	0.250070150+01	0.166346900+00	0.251235180+01	0.181544710+00

4. RESULTS

The trajectories are initiated on a month-by-month basis for all sixty sources beginning in January 1978 and ending in December 1980. So the basic data unit for this project is a set of ensembles of trajectories initiated in the time-span of one month.

The data graphically presented in this report are abstracted from the data base developed as the principal task of this project. This data base stores $W(k,t)$, $\bar{x}(k,t)$, $\bar{y}(k,t)$, $\sigma_x(k,t)$, $\sigma_y(k,t)$, and $\sigma_{xy}(k,t)$ for all pairings of sources k and travel-times t for three cases: unweighted, sulphur dioxide weighted, and sulphate weighted. Results for all three cases using the period comprising 1978 to 1980 are tabulated in Tables 4.1, 4.2, and 4.3 for the sources, Sudbury, Baldwin, and CONMJO ALLEG near Pittsburgh, Pennsylvania, respectively. Also listed in these tables are percentage weight remaining $a(k,t)$, the mean concentration $b(k,t)$ (where applicable), and the angle of orientation $\Theta(k,t)$.

Similar tables for the same three sources have been produced for the ensemble sets of 1980, 1979, 1978, January, April, July, October, January 1978 and July 1978. These are listed in Appendix A.

The mean trajectory for the month of January 1978 is plotted in Figure 4.1 for the source points located at Sudbury, Ontario, at Baldwin, Illinois and CONMJO ALLEG near Pittsburgh, Pennsylvania. The plotted squares indicate the location of the sources. The other graphic symbols indicate the points in the trajectory at each time step with line segments joining the centres of the symbols so that the time evolution is clear. Figure 4.2 illustrates the mean trajectories from the month of July 1978 for the same three sources. In Figure 4.2 we see the eastward movement that had also been expected for January 1978 but did not occur. When examining these figures, one should keep in mind that the actual dispersion about these means is very large, as has been indicated by Figures 2.2 to 2.6. Also, the percentage of trajectories remaining in the calculation of the statistics (see the corresponding tables in Appendix A) should be taken into account in the interpretation of the figures.

A logical period for which to estimate statistics consists of the same month in all three years. Figure 4.3 illustrates the mean trajectory for each of the aforementioned sources using trajectories from the month of January in all three years. The mean trajectories for January of these three years do not differ greatly from the mean trajectories for January 1978 which are depicted in Figure 4.1. The mean trajectories for the three sources estimated from trajectories generated in July of 1978, 1979 and 1980 are shown in Figure 4.4. The differences between these mean trajectories and their counterparts in Figure 4.2 for July 1978 are quite small.

The comparison of the January and July mean trajectories for the three sources shows stark differences for January and July. The July mean trajectories move eastward whereas the January trajectories move westward. When the tables in Apendix A corresponding to the Figures 4.1-4.4 are examined in conjunction with the figures, it is seen that the January patterns start deviating from their original courses when the number of trajectories remaining in the calculation of the statistics drop below about 95% of their original number. This usually happens between 12 and 36 h after initiation of the trajectories. This observation suggests the importance of loss of trajectories in estimating trajectory statistics.

A primary goal of this project was to estimate statistics from as large an ensemble of statistics as is possible. This is done by using all the trajectories generated from January 1978 to December 1980 for each source. Figures 4.5 through 4.8 depict mean trajectories from each source based on this period in groups of fifteen so that all the mean trajectories from the sixty sources are illustrated. The most striking feature about these mean trajectories is that they appear to converge towards the centre of the calculational domain. It can be seen from Tables 4.1-4.3 (% remaining) that loss of trajectories due to boundary effects may play a significant role in this behaviour.

Figures 4.9, 4.10 and 4.11 are two dimensional plots of the time evolution of the standard deviation of both x-and y-coordinates from the full period set of 8,652 trajectories for Sudbury, Baldwin, and CONMJÒ ALLEG near Pittsburgh, Pennsylvania, respectively. The figures all look very similar. For all three sources, the standard deviation of the y-coordinate exceeds the standard deviation of the x-coordinate for the first hours until sometime between 24 h and 42 h of elapsed travel time, when the situation is reversed and remains so until the last hour of travel time (96 h). The time evolution of both x and y standard deviations is smooth.

For each source, either standard deviation rises quickly at first from zero at initiation time but a virtual plateau is reached at about 48 h of travel-time where the value remains between 2.0 and 2.5. A cursory examination shows that for $t < 36$ h, both σ_x and σ_y are approximately proportional to $\sqrt{t}$. This implies that the constant eddy diffusivity assumption used in the derivation of the Gaussian distribution which forms the basis of the OME statistical model is physically realistic. For larger times, the limiting domain size may be the reason for the σ's becoming constant.

Table 4.1: Statistics for unweighted and sulphur dioxide weighted trajectories . Source - Sudbury 1978-80.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7880 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8652.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	8652.	100.0	25.837 ± 0.002	15.534 ± 0.002	0.201	0.221	0.005	6.7
6.	8652.	100.0	25.886 ± 0.004	15.510 ± 0.005	0.396	0.435	0.016	5.9
9.	8652.	100.0	25.935 ± 0.006	15.485 ± 0.007	0.582	0.641	0.033	5.5
12.	8652.	100.0	25.982 ± 0.008	15.461 ± 0.009	0.757	0.837	0.054	5.4
18.	8623.	99.7	26.054 ± 0.011	15.413 ± 0.013	1.063	1.184	0.123	6.2
24.	8552.	98.8	26.098 ± 0.014	15.381 ± 0.016	1.340	1.467	0.241	7.6
30.	8398.	97.1	26.108 ± 0.017	15.358 ± 0.018	1.585	1.677	0.377	8.5
36.	8205.	94.8	26.085 ± 0.020	15.331 ± 0.020	1.794	1.844	0.513	9.1
42.	7988.	92.3	26.042 ± 0.022	15.302 ± 0.022	1.968	1.966	0.595	8.7
48.	7718.	89.2	25.978 ± 0.024	15.273 ± 0.023	2.106	2.050	0.615	7.9
54.	7431.	85.9	25.906 ± 0.026	15.245 ± 0.024	2.225	2.099	0.619	7.1
60.	7175.	82.9	25.840 ± 0.027	15.237 ± 0.025	2.327	2.143	0.547	5.8
66.	6903.	79.8	25.781 ± 0.029	15.239 ± 0.026	2.396	2.161	0.458	4.6
72.	6638.	76.7	25.731 ± 0.030	15.227 ± 0.027	2.464	2.168	0.376	3.5
78.	6383.	73.8	25.692 ± 0.031	15.232 ± 0.027	2.509	2.173	0.326	3.0
84.	6135.	70.9	25.669 ± 0.033	15.273 ± 0.028	2.558	2.182	0.336	2.9
90.	5877.	67.9	25.631 ± 0.034	15.319 ± 0.029	2.606	2.190	0.286	2.2
96.	5635.	65.1	25.593 ± 0.035	15.350 ± 0.029	2.654	2.207	0.237	1.9

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7880 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	24061.102	100.0	2.781	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	20457.111	85.0	2.364	25.832 ± 0.001	15.527 ± 0.002	0.209	0.227	0.005	6.3
6.	17535.564	72.9	2.027	25.879 ± 0.003	15.491 ± 0.003	0.408	0.446	0.017	5.7
9.	15088.241	62.7	1.744	25.925 ± 0.005	15.452 ± 0.005	0.598	0.655	0.032	5.1
12.	13022.326	54.1	1.505	25.970 ± 0.007	15.410 ± 0.007	0.777	0.854	0.050	4.7
18.	9738.847	40.5	1.129	26.038 ± 0.011	15.320 ± 0.012	1.094	1.205	0.103	4.9
24.	7266.802	30.2	0.850	26.072 ± 0.016	15.247 ± 0.017	1.385	1.489	0.208	6.2
30.	5379.035	22.4	0.641	26.063 ± 0.022	15.185 ± 0.023	1.649	1.708	0.347	7.3
36.	3969.850	16.5	0.484	26.015 ± 0.030	15.111 ± 0.030	1.878	1.878	0.479	7.7
42.	2922.902	12.1	0.366	25.934 ± 0.038	15.043 ± 0.037	2.062	2.004	0.556	7.5
48.	2142.446	8.9	0.278	25.825 ± 0.048	14.982 ± 0.045	2.211	2.089	0.545	6.4
54.	1569.600	6.5	0.211	25.713 ± 0.059	14.935 ± 0.054	2.340	2.138	0.500	5.2
60.	1151.972	4.8	0.161	25.598 ± 0.072	14.921 ± 0.065	2.443	2.190	0.363	3.5
66.	842.355	3.5	0.122	25.489 ± 0.086	14.926 ± 0.076	2.509	2.217	0.181	1.7
72.	616.625	2.6	0.093	25.404 ± 0.104	14.909 ± 0.090	2.587	2.244	0.050	0.4
78.	450.049	1.9	0.071	25.309 ± 0.123	14.910 ± 0.106	2.611	2.256	-0.020	-0.2
84.	330.827	1.4	0.054	25.240 ± 0.145	14.949 ± 0.125	2.644	2.278	-0.059	-0.5
90.	242.683	1.0	0.041	25.166 ± 0.172	14.996 ± 0.147	2.687	2.295	-0.207	-1.6
96.	178.014	0.7	0.032	25.094 ± 0.204	15.031 ± 0.174	2.726	2.327	-0.345	-2.7

Table 4.1 (Cont'd): Statistics for sulphate weighted trajectories. Source - Sudbury 1978-80.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7880 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1513.705	100.0	0.175	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	1991.804	131.6	0.230	25.844 ± 0.004	15.529 ± 0.005	0.192	0.209	0.006	8.9
6.	2443.223	161.4	0.282	25.900 ± 0.008	15.494 ± 0.008	0.372	0.406	0.022	9.2
9.	2777.682	183.5	0.321	25.951 ± 0.010	15.448 ± 0.011	0.543	0.591	0.044	8.5
12.	3023.797	199.8	0.349	26.002 ± 0.013	15.399 ± 0.014	0.706	0.768	0.068	7.8
18.	3312.602	218.8	0.384	26.090 ± 0.017	15.292 ± 0.019	0.999	1.082	0.133	7.6
24.	3326.442	219.8	0.389	26.145 ± 0.022	15.175 ± 0.023	1.273	1.342	0.231	8.1
30.	3201.789	211.5	0.381	26.177 ± 0.027	15.066 ± 0.027	1.532	1.534	0.383	9.3
36.	2995.005	197.9	0.365	26.178 ± 0.032	14.967 ± 0.031	1.764	1.687	0.516	9.4
42.	2751.165	181.8	0.344	26.154 ± 0.038	14.891 ± 0.034	1.972	1.807	0.616	9.0
48.	2471.838	163.3	0.320	26.121 ± 0.044	14.842 ± 0.038	2.166	1.896	0.655	8.0
54.	2170.712	143.4	0.292	26.084 ± 0.050	14.815 ± 0.042	2.331	1.963	0.658	6.9
60.	1886.367	124.6	0.263	26.013 ± 0.056	14.797 ± 0.047	2.440	2.028	0.544	5.2
66.	1611.669	106.5	0.233	25.952 ± 0.063	14.769 ± 0.052	2.538	2.070	0.421	3.7
72.	1365.072	90.2	0.206	25.916 ± 0.071	14.719 ± 0.057	2.635	2.114	0.261	2.2
78.	1161.996	76.8	0.182	25.853 ± 0.079	14.714 ± 0.063	2.682	2.138	0.192	1.5
84.	991.781	65.5	0.162	25.796 ± 0.087	14.712 ± 0.069	2.727	2.159	0.046	0.4
90.	832.256	55.0	0.142	25.760 ± 0.095	14.721 ± 0.076	2.754	2.184	-0.004	-0.0
96.	689.532	45.6	0.122	25.752 ± 0.105	14.700 ± 0.086	2.751	2.250	-0.063	-0.5

Table 4.2: Statistics for unweighted and sulphur dioxide weighted trajectories. Source - Baldwin 1978-80.

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7880 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8652.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	8652.	100.0	23.434 ± 0.002	13.126 ± 0.003	0.205	0.239	0.009	12.1
6.	8652.	100.0	23.452 ± 0.004	13.154 ± 0.005	0.411	0.466	0.036	11.9
9.	8652.	100.0	23.463 ± 0.007	13.191 ± 0.007	0.615	0.675	0.080	11.9
12.	8650.	100.0	23.471 ± 0.009	13.237 ± 0.009	0.809	0.867	0.136	11.8
18.	8564.	99.0	23.495 ± 0.012	13.367 ± 0.013	1.139	1.167	0.233	10.2
24.	8456.	97.7	23.528 ± 0.015	13.525 ± 0.015	1.421	1.403	0.321	9.0
30.	8311.	96.1	23.576 ± 0.018	13.702 ± 0.017	1.653	1.594	0.363	7.6
36.	8172.	94.5	23.622 ± 0.020	13.869 ± 0.019	1.848	1.768	0.370	6.2
42.	8018.	92.7	23.680 ± 0.022	14.024 ± 0.021	2.006	1.874	0.326	4.6
48.	7830.	90.5	23.746 ± 0.024	14.166 ± 0.022	2.128	1.968	0.253	3.2
54.	7617.	88.0	23.788 ± 0.026	14.296 ± 0.023	2.230	2.031	0.171	2.0
60.	7423.	85.8	23.810 ± 0.027	14.406 ± 0.024	2.323	2.088	0.061	0.7
66.	7191.	83.1	23.857 ± 0.028	14.502 ± 0.025	2.390	2.130	0.039	0.4
72.	6966.	80.5	23.889 ± 0.029	14.595 ± 0.026	2.444	2.178	-0.073	-0.7
78.	6700.	77.4	23.931 ± 0.030	14.691 ± 0.027	2.478	2.196	-0.101	-0.9
84.	6428.	74.3	23.976 ± 0.031	14.778 ± 0.028	2.496	2.211	-0.125	-1.2
90.	6190.	71.5	24.030 ± 0.032	14.858 ± 0.028	2.521	2.229	-0.172	-1.6
96.	5947.	68.7	24.076 ± 0.033	14.908 ± 0.029	2.535	2.233	-0.202	-1.8

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7880 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	24061.102	100.0	2.781	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	20852.837	86.7	2.410	23.432 ± 0.001	13.109 ± 0.002	0.212	0.251	0.011	13.5
6.	18116.448	75.3	2.094	23.447 ± 0.003	13.119 ± 0.004	0.425	0.485	0.043	13.4
9.	15753.793	65.5	1.821	23.457 ± 0.005	13.139 ± 0.006	0.635	0.699	0.096	13.3
12.	13702.784	56.9	1.584	23.463 ± 0.007	13.167 ± 0.008	0.836	0.895	0.162	13.0
18.	10265.714	42.7	1.199	23.488 ± 0.012	13.275 ± 0.012	1.172	1.190	0.264	10.9
24.	7679.803	31.9	0.908	23.521 ± 0.017	13.416 ± 0.016	1.456	1.428	0.351	9.4
30.	5732.135	23.8	0.690	23.562 ± 0.022	13.577 ± 0.022	1.690	1.636	0.382	7.6
36.	4272.898	17.8	0.523	23.598 ± 0.029	13.733 ± 0.028	1.883	1.807	0.350	5.6
42.	3178.115	13.2	0.396	23.638 ± 0.036	13.874 ± 0.034	2.037	1.943	0.244	3.4
48.	2354.844	9.8	0.301	23.676 ± 0.045	14.002 ± 0.042	2.160	2.033	0.092	1.1
54.	1742.654	7.2	0.229	23.683 ± 0.054	14.116 ± 0.050	2.264	2.094	-0.039	-0.4
60.	1291.846	5.4	0.174	23.682 ± 0.065	14.227 ± 0.060	2.349	2.169	-0.168	-1.7
66.	950.571	4.0	0.132	23.712 ± 0.078	14.315 ± 0.072	2.415	2.227	-0.137	-1.3
72.	698.943	2.9	0.100	23.709 ± 0.093	14.382 ± 0.087	2.454	2.290	-0.281	-2.7
78.	508.945	2.1	0.076	23.717 ± 0.109	14.433 ± 0.102	2.454	2.310	-0.375	-3.6
84.	369.868	1.5	0.058	23.731 ± 0.127	14.481 ± 0.121	2.452	2.322	-0.473	-4.5
90.	271.260	1.1	0.044	23.754 ± 0.150	14.521 ± 0.141	2.465	2.330	-0.585	-5.5
96.	199.948	0.8	0.034	23.793 ± 0.174	14.536 ± 0.165	2.465	2.328	-0.610	-5.7

Table 4.2 (Cont'd): Statistics for sulphate weighted trajectories. Source - Baldwin 1978-80.

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7880 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1513.705	100.0	0.175	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	2245.201	148.3	0.260	23.442 ± 0.004	13.128 ± 0.005	0.193	0.225	0.010	14.3
6.	2870.897	189.7	0.332	23.470 ± 0.007	13.160 ± 0.008	0.382	0.429	0.037	14.1
9.	3350.316	221.3	0.387	23.494 ± 0.010	13.196 ± 0.011	0.569	0.617	0.079	13.8
12.	3698.725	244.3	0.428	23.516 ± 0.012	13.230 ± 0.013	0.747	0.789	0.133	13.4
18.	4088.734	270.1	0.477	23.570 ± 0.016	13.313 ± 0.017	1.048	1.057	0.226	11.6
24.	4141.583	273.6	0.490	23.632 ± 0.020	13.403 ± 0.020	1.301	1.282	0.314	10.5
30.	4001.283	264.3	0.481	23.687 ± 0.024	13.497 ± 0.023	1.510	1.477	0.351	8.8
36.	3711.358	245.2	0.454	23.732 ± 0.028	13.569 ± 0.027	1.685	1.621	0.331	6.6
42.	3395.464	224.3	0.423	23.781 ± 0.032	13.643 ± 0.030	1.841	1.746	0.280	4.7
48.	3056.487	201.9	0.390	23.826 ± 0.036	13.736 ± 0.033	1.969	1.846	0.182	2.7
54.	2722.842	179.9	0.357	23.855 ± 0.040	13.814 ± 0.037	2.063	1.921	0.133	1.8
60.	2393.590	158.1	0.322	23.876 ± 0.044	13.888 ± 0.041	2.137	2.006	0.031	0.4
66.	2067.880	136.6	0.288	23.909 ± 0.049	13.936 ± 0.046	2.207	2.080	0.011	0.1
72.	1776.726	117.4	0.255	23.921 ± 0.053	13.941 ± 0.050	2.238	2.128	-0.125	-1.4
78.	1508.437	99.7	0.225	23.965 ± 0.058	13.950 ± 0.055	2.254	2.153	-0.263	-3.0
84.	1272.901	84.1	0.198	24.007 ± 0.064	13.984 ± 0.061	2.271	2.179	-0.384	-4.3
90.	1087.496	71.8	0.176	24.062 ± 0.070	14.010 ± 0.066	2.297	2.170	-0.428	-4.6
96.	936.755	61.9	0.158	24.126 ± 0.075	14.006 ± 0.071	2.302	2.171	-0.346	-3.7

Table 4.3: Statistics for unweighted and sulphur dioxide weighted trajectories. Source CONMJO ALLEG 1978-80.

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7980 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8652.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	8652.	100.0	26.213 ± 0.002	13.645 ± 0.003	0.200	0.243	0.008	11.8
6.	8652.	100.0	26.259 ± 0.004	13.647 ± 0.005	0.397	0.476	0.035	12.6
9.	8641.	99.9	26.295 ± 0.006	13.658 ± 0.007	0.587	0.691	0.085	13.8
12.	8618.	99.6	26.323 ± 0.008	13.676 ± 0.010	0.769	0.887	0.158	14.9
18.	8477.	98.0	26.348 ± 0.012	13.732 ± 0.013	1.093	1.210	0.362	16.8
24.	8288.	95.8	26.345 ± 0.015	13.801 ± 0.016	1.375	1.472	0.607	17.8
30.	8065.	93.2	26.331 ± 0.018	13.886 ± 0.019	1.625	1.683	0.871	18.3
36.	7759.	89.7	26.294 ± 0.021	13.975 ± 0.021	1.832	1.841	1.126	18.5
42.	7441.	86.0	26.232 ± 0.023	14.041 ± 0.023	2.005	1.964	1.353	18.6
48.	7124.	82.3	26.168 ± 0.025	14.105 ± 0.024	2.145	2.054	1.526	18.4
54.	6763.	78.2	26.081 ± 0.028	14.155 ± 0.025	2.263	2.095	1.622	17.6
60.	6445.	74.5	26.021 ± 0.030	14.210 ± 0.026	2.380	2.124	1.680	16.5
66.	6138.	70.9	25.965 ± 0.031	14.273 ± 0.027	2.468	2.153	1.694	15.5
72.	5838.	67.5	25.855 ± 0.033	14.324 ± 0.028	2.542	2.175	1.591	13.8
78.	5565.	64.3	25.787 ± 0.035	14.393 ± 0.029	2.612	2.200	1.516	12.5
84.	5314.	61.4	25.730 ± 0.037	14.442 ± 0.030	2.669	2.219	1.417	11.3
90.	5055.	58.4	25.669 ± 0.038	14.480 ± 0.031	2.700	2.228	1.440	11.2
96.	4834.	55.9	25.653 ± 0.039	14.547 ± 0.032	2.737	2.244	1.397	10.6

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7880 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	24061.102	100.0	2.781	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	20677.166	85.9	2.390	26.215 ± 0.001	13.636 ± 0.002	0.209	0.254	0.009	11.2
6.	17847.030	74.3	2.067	26.263 ± 0.003	13.626 ± 0.004	0.412	0.496	0.036	12.1
9.	15495.211	64.4	1.793	26.300 ± 0.005	13.622 ± 0.006	0.607	0.719	0.088	13.5
12.	13412.538	55.7	1.556	26.328 ± 0.007	13.624 ± 0.008	0.793	0.920	0.166	14.8
18.	9947.002	41.3	1.173	26.344 ± 0.011	13.646 ± 0.012	1.125	1.246	0.380	16.7
24.	7329.006	30.5	0.884	26.316 ± 0.017	13.671 ± 0.018	1.414	1.502	0.627	17.4
30.	5368.944	22.3	0.666	26.266 ± 0.023	13.703 ± 0.023	1.668	1.703	0.883	17.6
36.	3876.109	16.1	0.500	26.195 ± 0.030	13.738 ± 0.030	1.874	1.837	1.111	17.6
42.	2787.102	11.6	0.375	26.097 ± 0.039	13.741 ± 0.037	2.043	1.946	1.315	17.5
48.	2007.529	8.3	0.282	26.004 ± 0.049	13.737 ± 0.045	2.188	2.033	1.492	17.3
54.	1471.890	6.0	0.212	25.880 ± 0.061	13.712 ± 0.054	2.292	2.054	1.526	16.2
60.	1027.733	4.3	0.159	25.798 ± 0.075	13.732 ± 0.065	2.403	2.080	1.553	15.0
66.	735.826	3.1	0.120	25.683 ± 0.092	13.772 ± 0.078	2.486	2.108	1.538	14.0
72.	528.442	2.2	0.091	25.560 ± 0.111	13.808 ± 0.093	2.552	2.134	1.379	12.0
78.	381.389	1.6	0.069	25.451 ± 0.134	13.854 ± 0.111	2.612	2.162	1.201	10.0
84.	276.333	1.1	0.052	25.364 ± 0.160	13.877 ± 0.130	2.659	2.160	0.965	7.8
90.	199.001	0.8	0.039	25.299 ± 0.188	13.886 ± 0.151	2.649	2.134	0.948	7.7
96.	146.038	0.6	0.030	25.271 ± 0.219	13.943 ± 0.177	2.649	2.140	0.866	7.0

Table 4.3 (Cont'd): Statistics for sulphate weighted trajectories. Source CONMJO ALLEG. 1978-80.

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7880 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1513.705	100.0	0.175	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	2164.766	143.0	0.250	26.217 ± 0.004	13.636 ± 0.005	0.189	0.228	0.009	14.0
6.	2729.392	180.3	0.315	26.268 ± 0.007	13.627 ± 0.008	0.370	0.438	0.035	14.4
9.	3176.127	209.8	0.368	26.314 ± 0.010	13.619 ± 0.011	0.544	0.629	0.081	15.4
12.	3507.316	231.7	0.407	26.352 ± 0.012	13.611 ± 0.013	0.715	0.797	0.149	16.3
18.	3863.496	255.2	0.456	26.396 ± 0.016	13.597 ± 0.017	1.025	1.067	0.333	17.6
24.	3883.615	256.6	0.469	26.401 ± 0.021	13.573 ± 0.021	1.297	1.278	0.561	18.5
30.	3719.328	245.7	0.461	26.394 ± 0.025	13.559 ± 0.024	1.542	1.440	0.793	18.5
36.	3399.057	224.6	0.438	26.395 ± 0.030	13.548 ± 0.027	1.759	1.549	1.017	18.2
42.	3004.467	198.5	0.404	26.360 ± 0.035	13.503 ± 0.030	1.919	1.644	1.192	18.0
48.	2642.186	174.6	0.371	26.331 ± 0.040	13.462 ± 0.033	2.081	1.716	1.383	17.7
54.	2282.386	150.8	0.337	26.313 ± 0.047	13.453 ± 0.037	2.230	1.765	1.583	17.7
60.	1957.240	129.3	0.304	26.323 ± 0.053	13.491 ± 0.041	2.344	1.816	1.703	17.2
66.	1652.146	109.1	0.269	26.286 ± 0.059	13.528 ± 0.046	2.412	1.858	1.748	16.7
72.	1387.675	91.7	0.238	26.262 ± 0.067	13.558 ± 0.051	2.483	1.890	1.796	16.2
78.	1163.497	76.9	0.209	26.241 ± 0.075	13.584 ± 0.056	2.591	1.914	1.870	15.6
84.	962.933	63.6	0.181	26.162 ± 0.085	13.584 ± 0.062	2.632	1.917	1.720	13.9
90.	809.823	53.5	0.160	26.129 ± 0.093	13.584 ± 0.067	2.634	1.900	1.755	14.2
96.	694.082	45.9	0.144	26.099 ± 0.100	13.623 ± 0.073	2.635	1.914	1.720	13.9

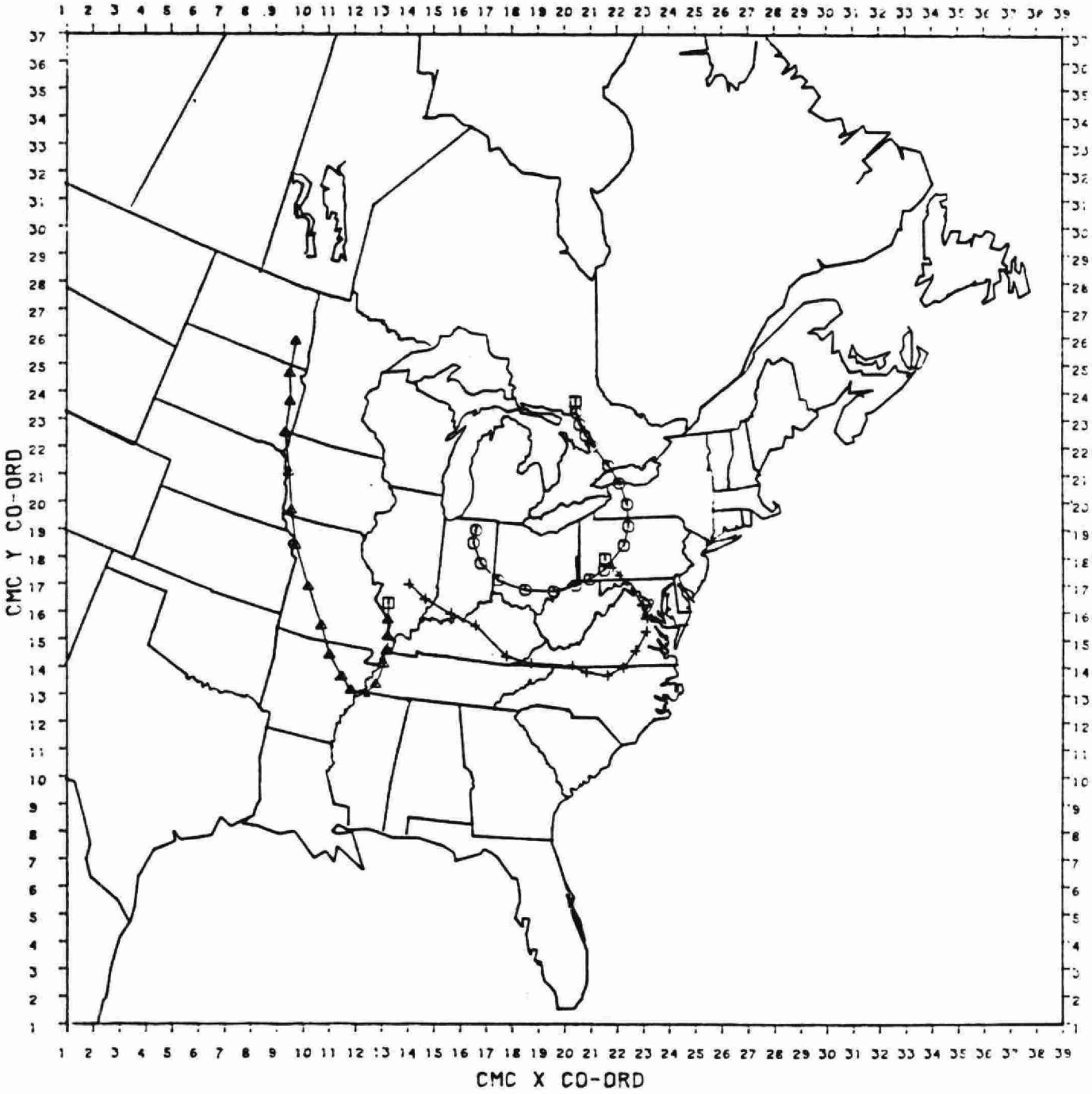

Figure 4.1: Mean trajectories for Sudbury, Baldwin, and CONMJO ALLEG. January 1978. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

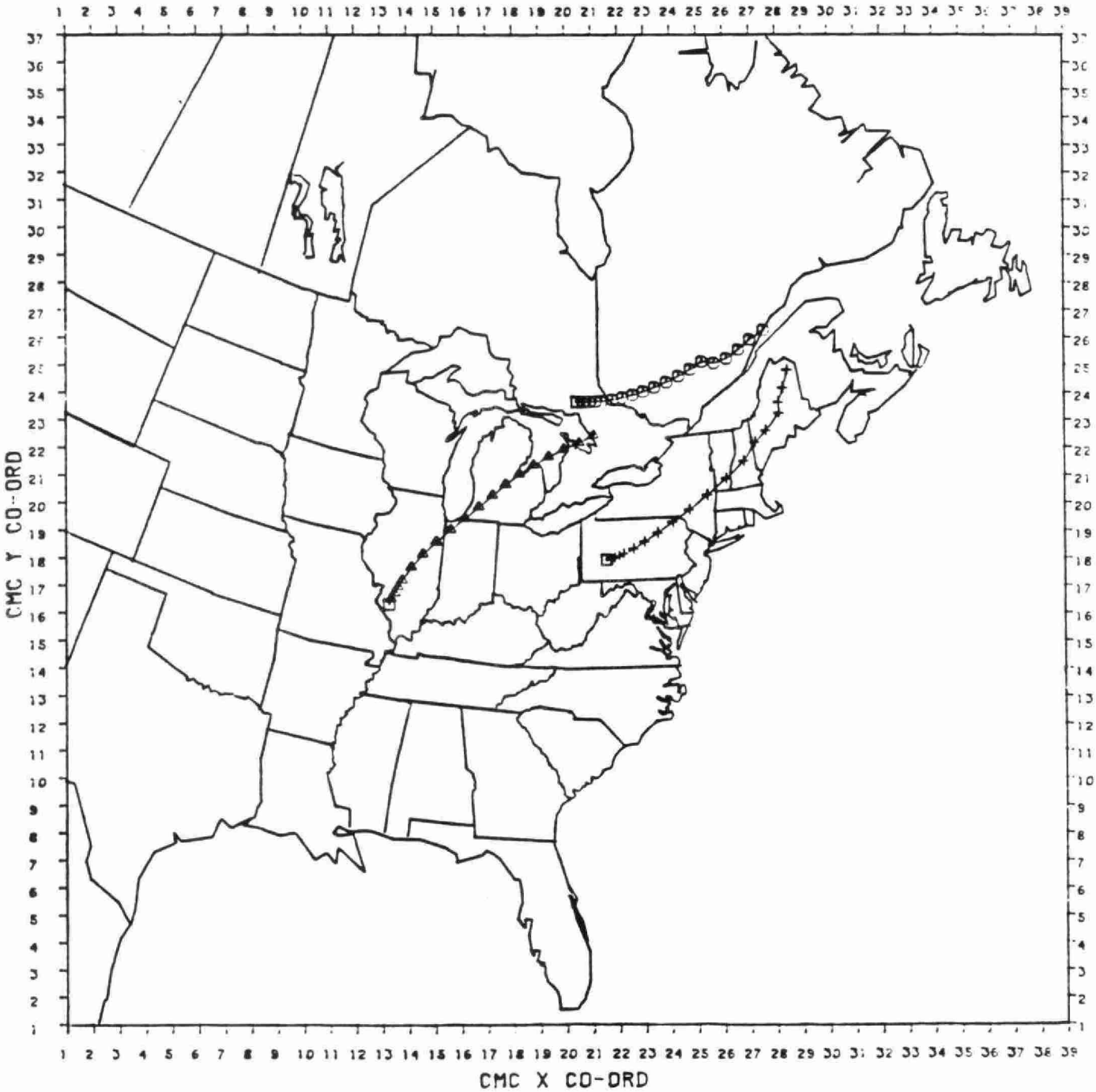

Figure 4.2: Mean trajectories for Sudbury, Baldwin, and CONMJO ALLEG. July 1978. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

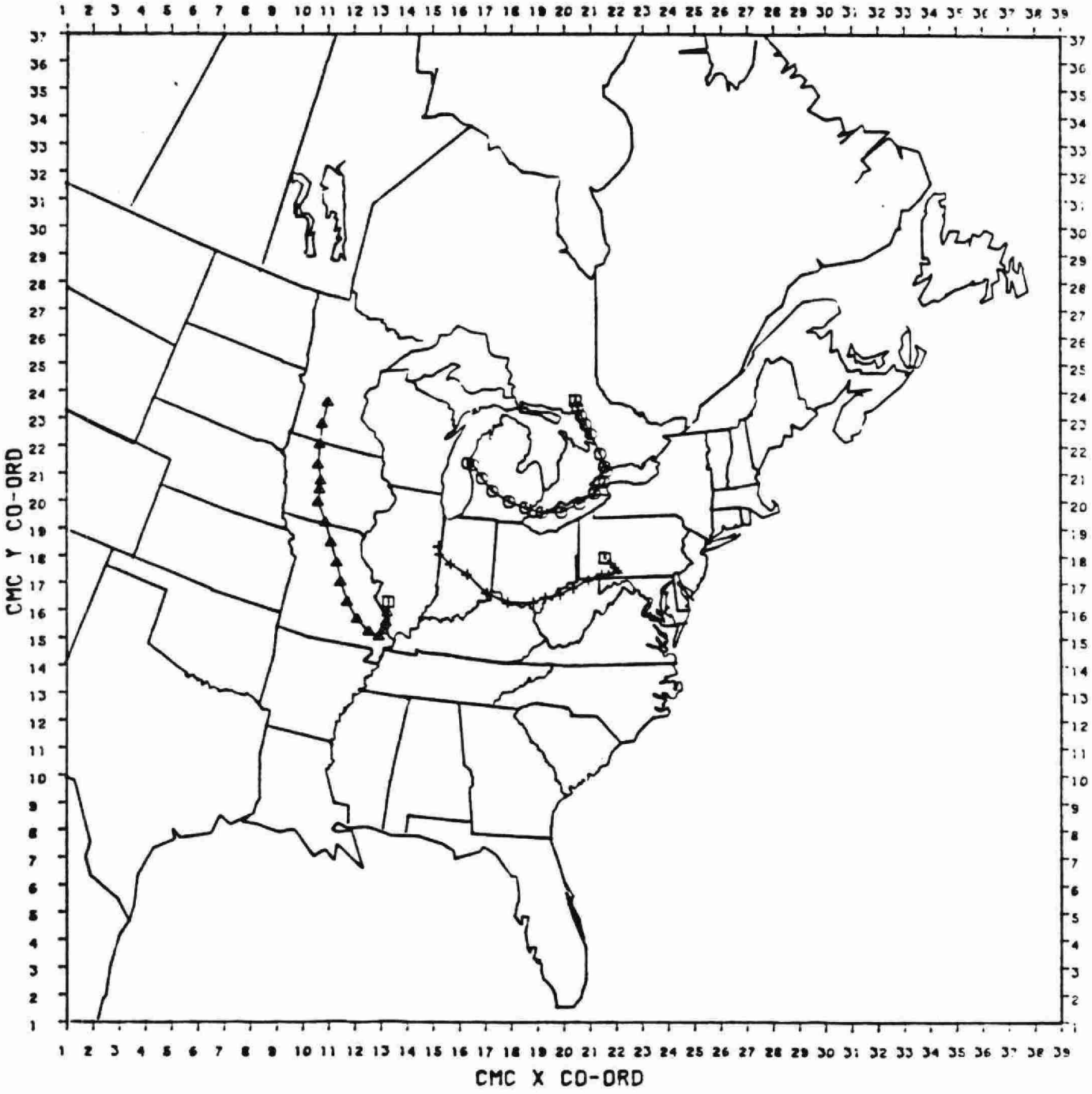

Figure 4.3: Mean trajectories for Sudbury, Baldwin, and CONMJO ALLEG. January 1978/79/80. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

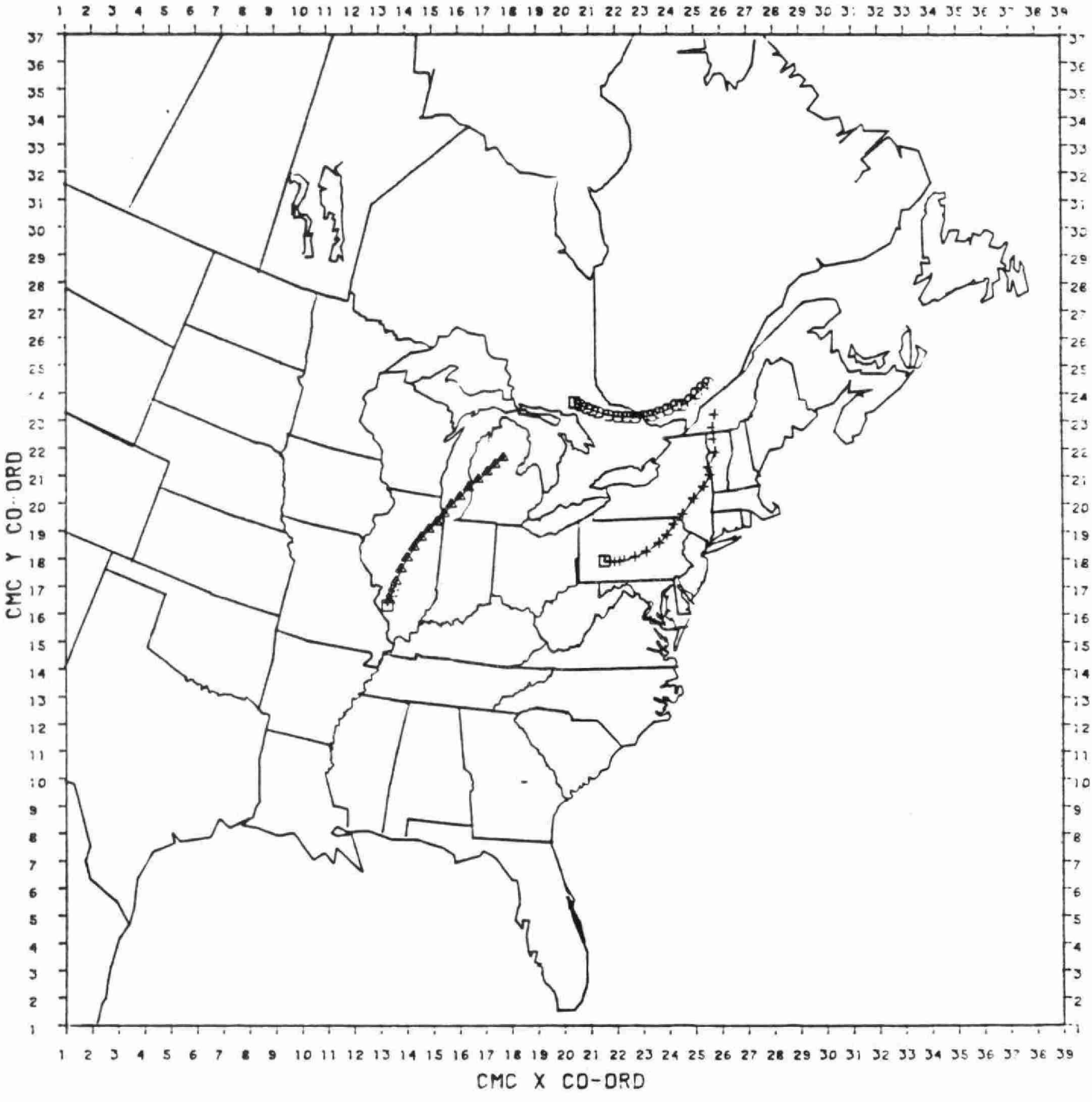

Figure 4.4: Mean trajectories for Sudbury, Baldwin, and CONMJO ALLEG. July 1978/79/80. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

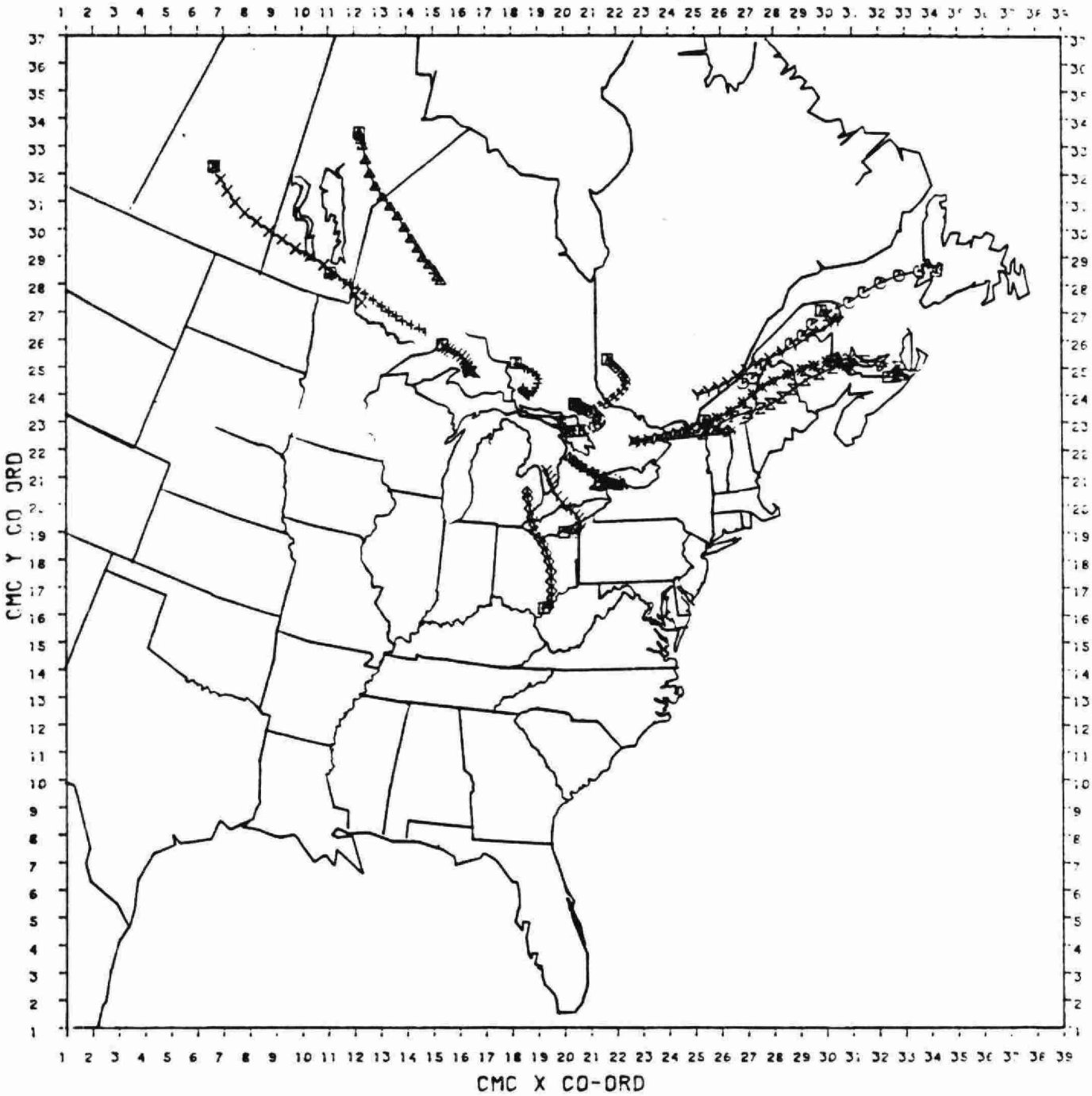

Figure 4.5: Mean trajectories generated form January 1978 to December 1980 for each source. Sources 1-15. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

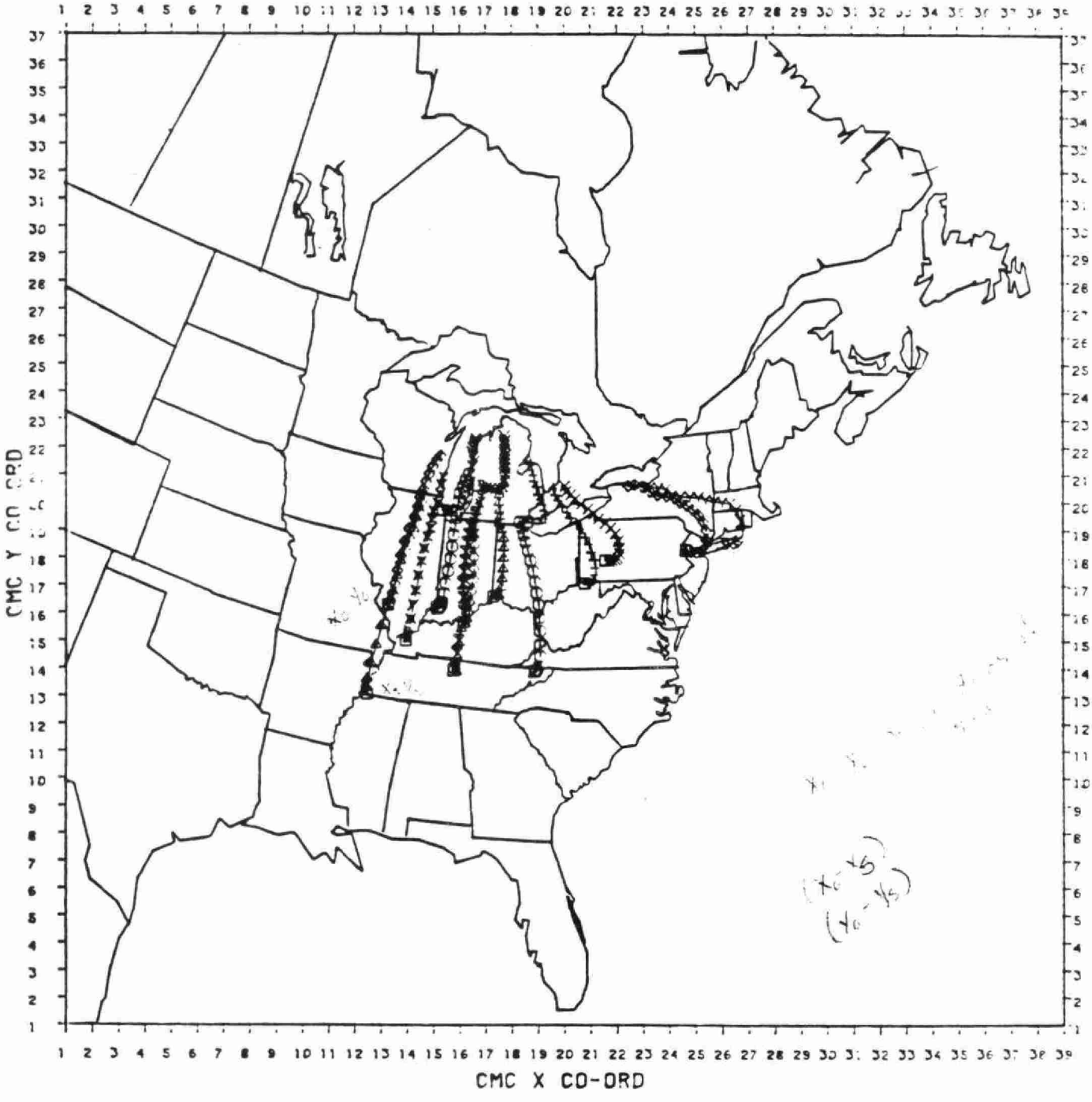

Figure 4.6: Mean trajectories generated from January 1978 to December 1980 for each source. Sources 16 - 30. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

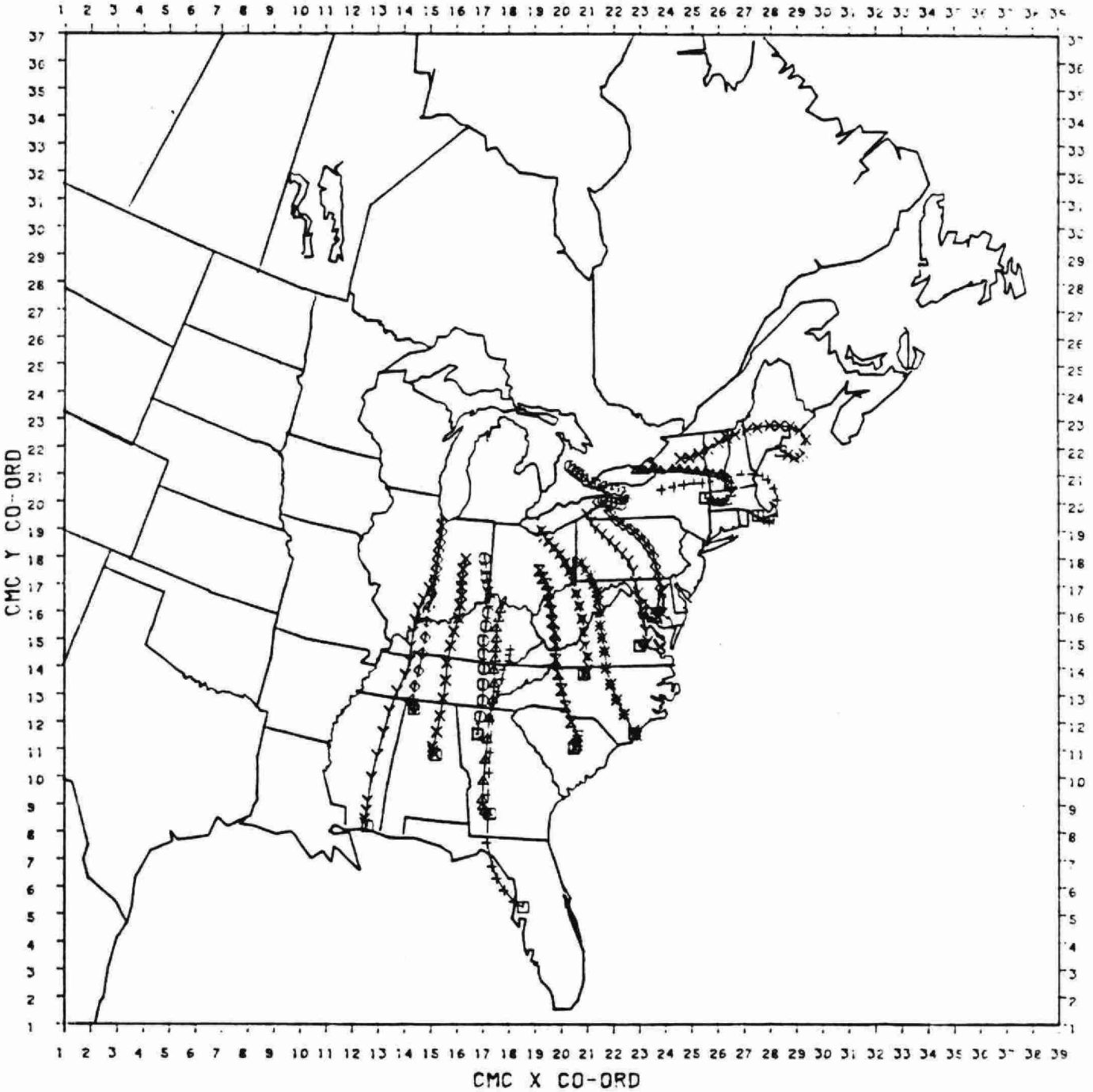

Figure 4.7: Mean trajectories generated from January 1978 to December 1980 for each source. Sources 31 - 45. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

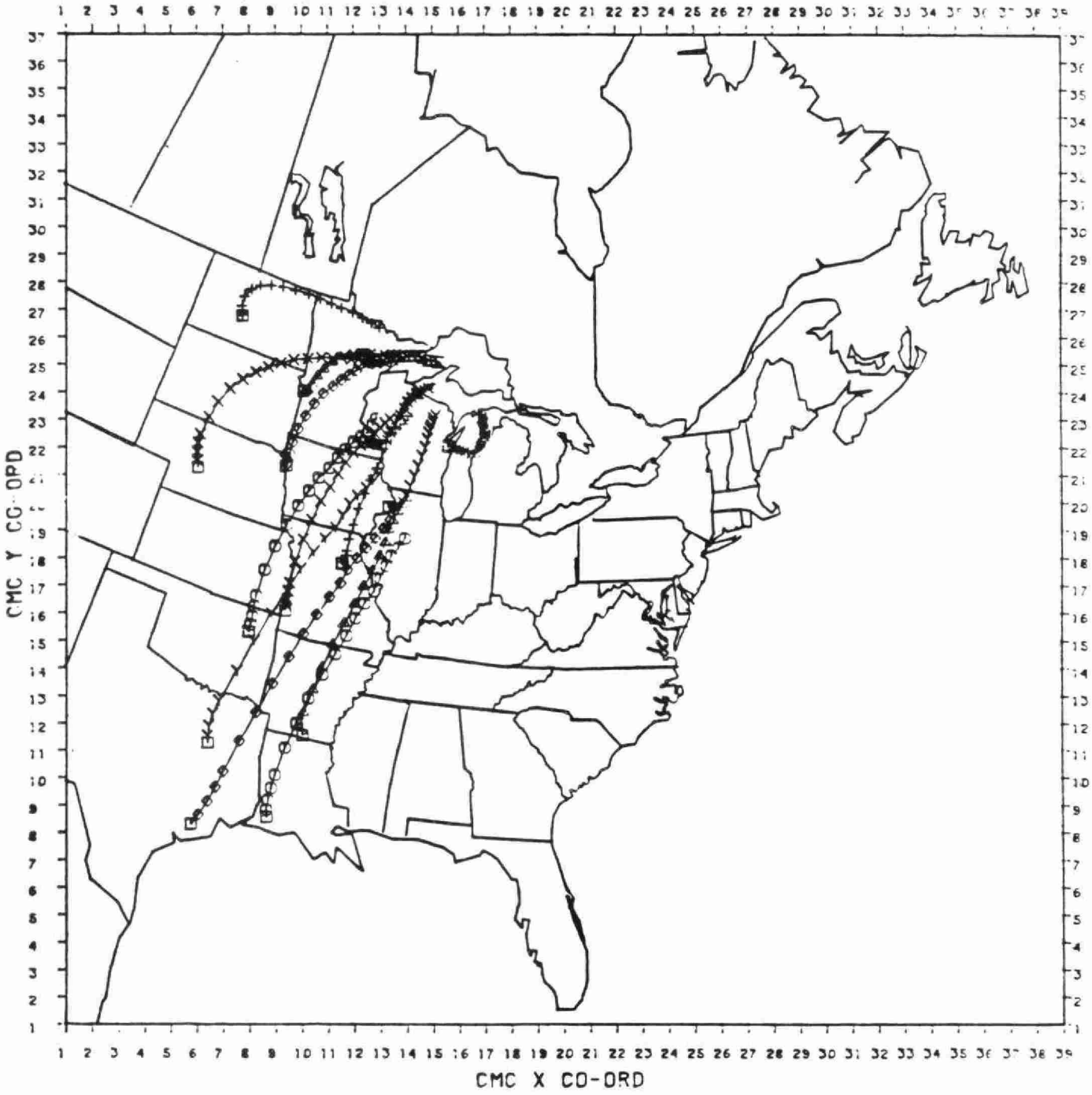

Figure 4.8: Mean trajectories generated from January 1978 to December 1980 for each source. Sources 46 - 60. Note that these trajectories do not necessarily represent the path followed by any puff of pollutant and cannot be used for modelling long range transport without a knowledge of the dispersion about them.

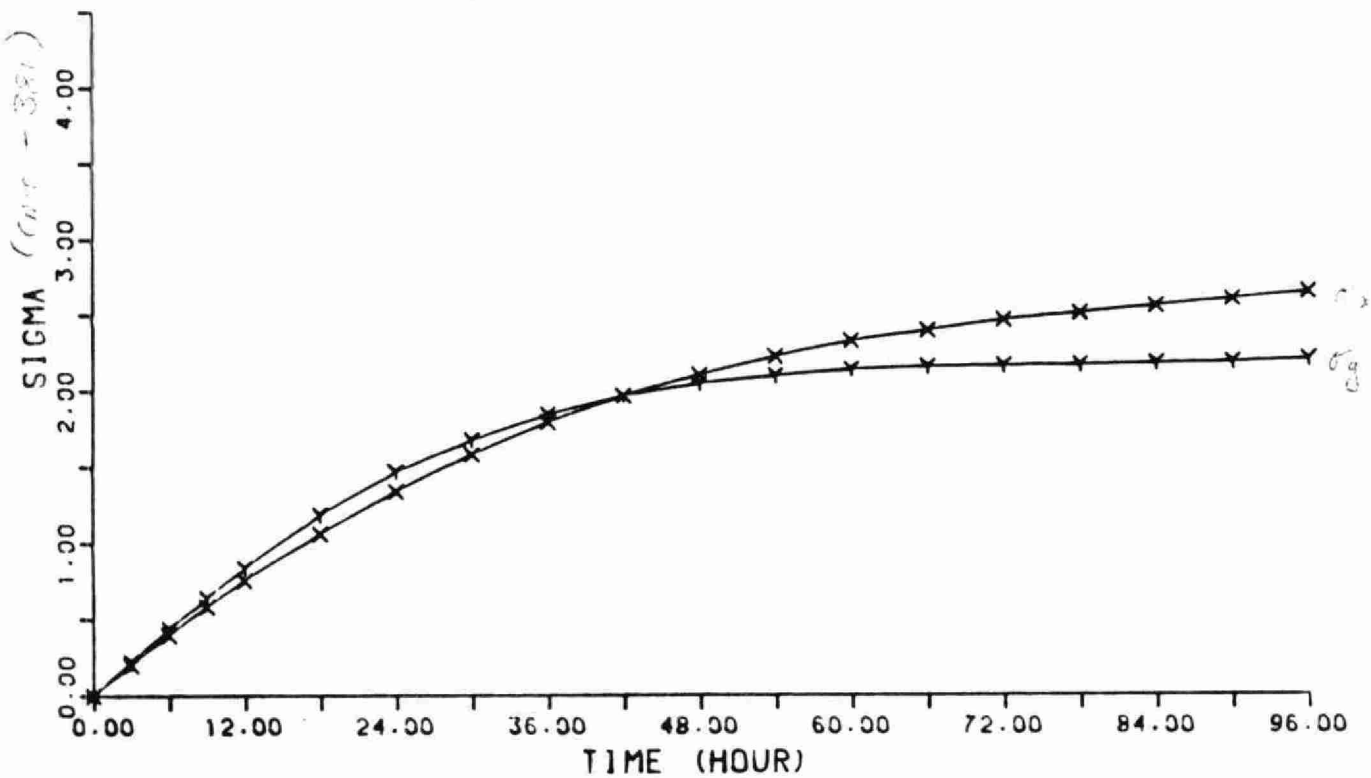

Figure 4.9: Plot of time evolution versus standard deviation of the x- and y- coordinates. Source - Sudbury.

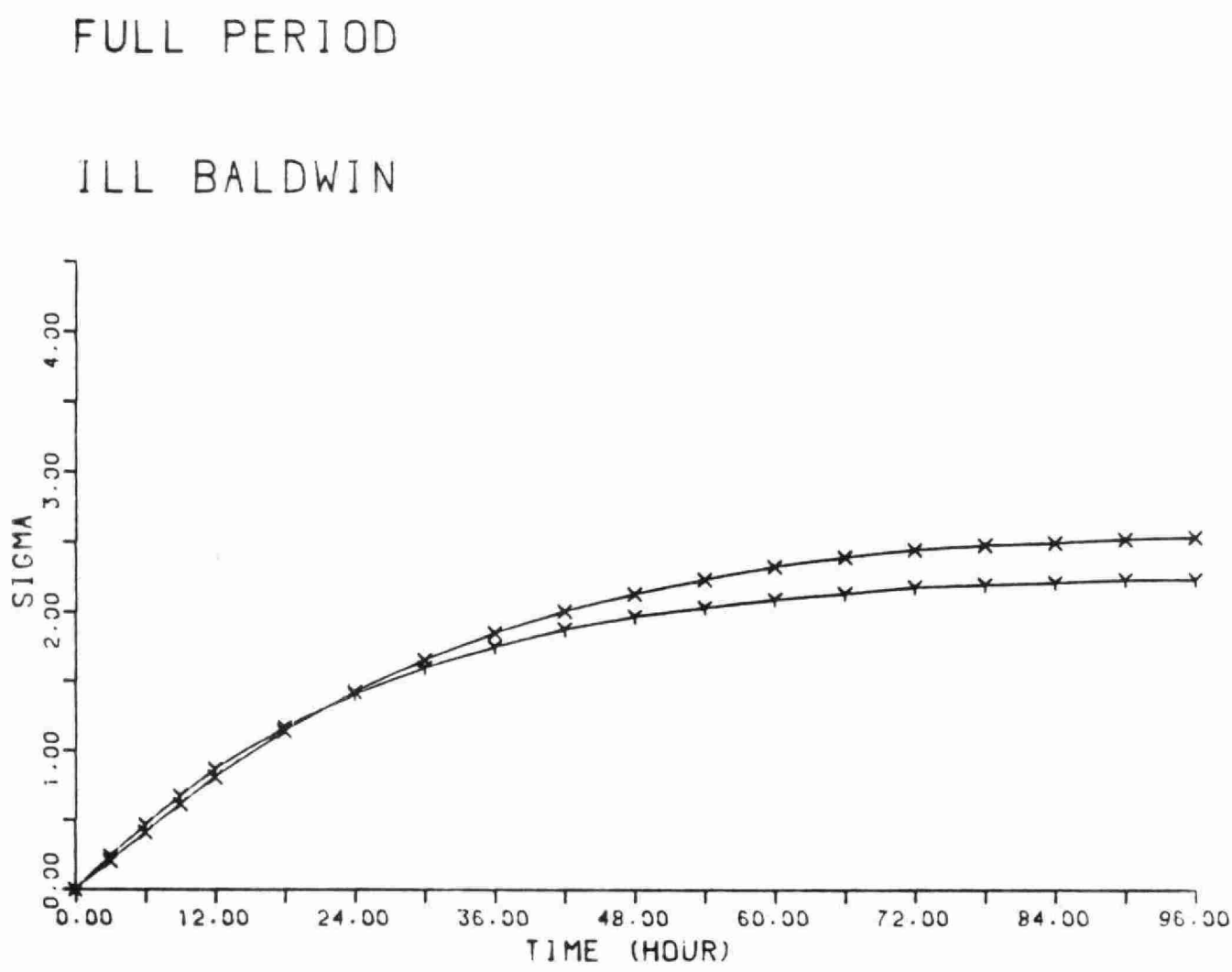

Figure 4.10: Plot of time evolution versus standard deviation of the x- and y- coordinates. Source - Baldwin.

FULL PERIOD

PEN CONMJO ALLEG

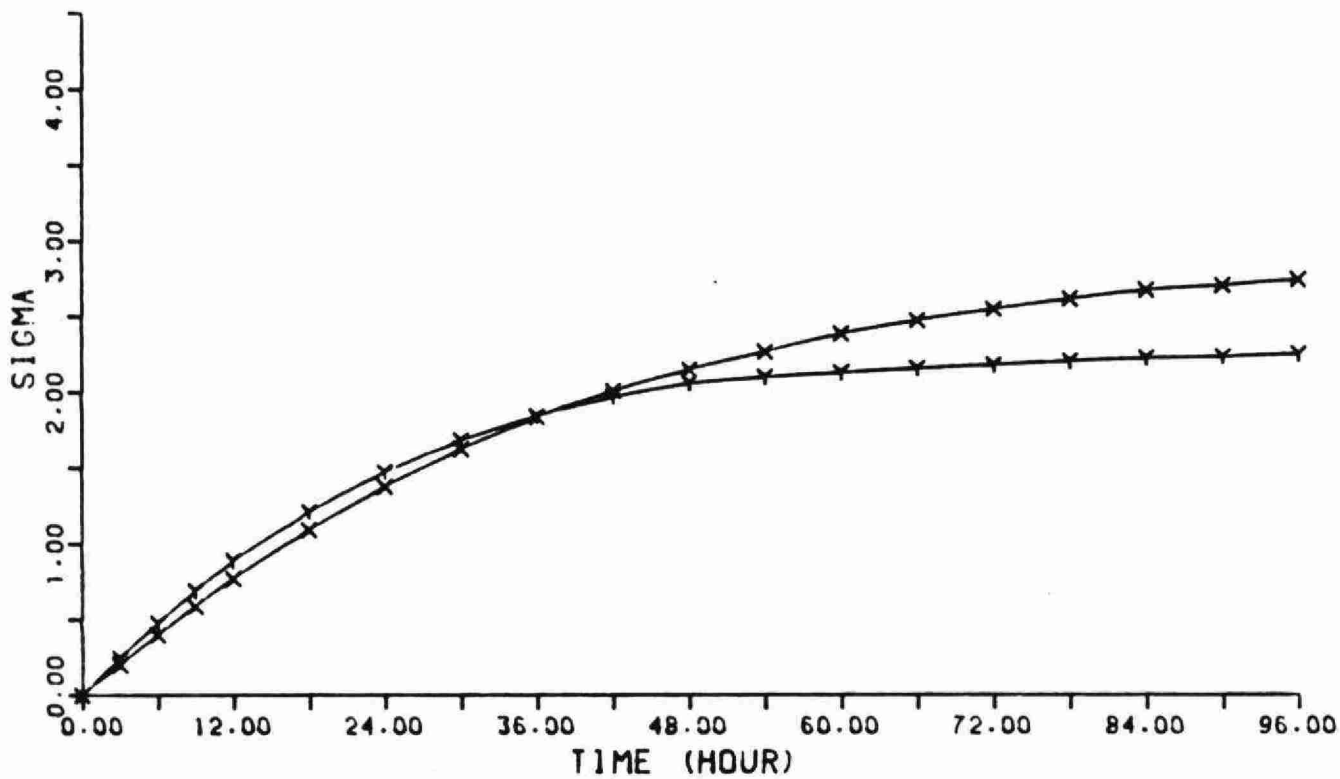

Figure 4.11: Plot of time evolution versus standard deviation of the x- and y- coordinates. Source - CONMJO ALLEG.

5. SUMMARY AND RECOMMENDATIONS

The most significant findings of the present study are those given in Figures 4.5 - 4.11, which show the means of the trajectories initiated from all sixty sources every three hours for a period of three years, and the standard deviations about these means for selected sources. The means of the trajectory-end-points do not go in a west to east direction which is rather expected for trajectories that are based on surface winds. Since the travel of pollutant parcels are expected to be also affected somewhat by upper level winds, a comparison of January and July 1982 surface and 850mb trajectories were undertaken and reported in the ADDENDUM to this report. These comparisons between the two different level trajectory statistics pointed to some difficulties due to small sample size and possibly due to domain boundary effects to a significant degree. It was found however that 850mb trajectories, in general, move farther away than the surface trajectories and in a more intuitively expected direction. Also, winter time trajectories tend to behave in a more unexpected fashion than summer time trajectories. An examination of the percentage loss of trajectories as a function of time from trajectory initiation strongly suggest the importance of trajectory loss in estimating trajectory statistics.

The results point out to several potential difficulties in the Lagrangian and the statistical model formulations.

1. The first area of concern is the wind field formulation in the Lagrangian model, especially in the calculation of the surface winds from surface pressure data, and perhaps more importantly, the choice of a single level (e.g., surface versus 850mb) for which the calculated winds would be representative of pollutant transport. The following suggestions could be made with the aim of improving the model assumptions:

   i) Comparison of trajectories with available tetroon-trajectory data, (Hoecker, 1977, Pack et al., 1978; Warner, 1981; Reisinger and Mueller, 1983), and tracer experiments (e.g., CAPTEX),

   ii) Comparison of trajectories with those generated by other available trajectory models,

   iii) Continued comparison of Lagrangian Model results (including the mass budget calculations) to available air quality and deposition data or predictions from Eulerian Models (this comparison however is not very useful for evaluating the trajectory module only),

   iv) Use of a combination of the trajectories for the two levels for pollutant transport modelling.

2. Another area of concern is that pointed out by the 850mb-surface comparison study and also by an examination of the percentage of remaining trajectories, namely boundary effects and early termination of trajectories. It is suggested that:

   i) Reasons for trajectory termination be studied quantitatively, i.e., determine if a trajectory is terminated due to edge of calculation domain, gaps in data, or non-convergence due to data sparsity near oceans, and produce statistics on the occurrence of these reasons (this would indicate which source of inaccuracy would be tackled first),

   ii) Related to (i) above, if it is found that domain boundary effects are significant, trajectories for a subset of the data be calculated using a larger calculation domain than presently used and their statistics compared to the corresponding statistics calculated in the present study,

   iii) A larger database be used for the 850mb and surface comparisons,

   iv) The trajectory statistics for "percentage remaining" less that ~ 95 % not be used until (i) above is completed.

The aim of the present study was to generate the statistical parameters for use in the OME Statistical Model. To further pursue this goal, the following recommendations are made:

3. Examination of the effect of the coordinate system (i.e., the CMC grid) on the statistics generated, by comparing them to those calculated using the "tangent plane" approach described in the interim report (Alp and Moran, 1983; note that the latter approach has not yet been fully tested),

4. Test for normality of the distribution of trajectory end-points to determine the suitability of the Gaussian distribution used in the Statistical Model,

5. The present results indicate that using $\bar{x} = u\tau$ and $\bar{y} = 0$ in the Statistical Model (see the interim report, Alp and Moran, 1983) may be inappropriate. For this reason it is recommended that the statistics generated in the present study be implemented in the Statistical Model and its predictions be compared to available air quality and deposition data.

6. The present results indicate that at least for certain sources, the mean trajectories move very little and the diffusion ellipses are close to circular. Thus, in order to quantify the differences in

various directions more accurately, a splitting of the statistical model calculation domain into sectors may be more appropriate. This may be accomplished by using a one-dimensional distribution for each sector instead of the presently used two-dimensional distribution function. Parameters for such a distribution may be determined from the presently used trajectory end-point data, but using perhaps $\bar{r}_i$ to indicated mean trajectory movement in each sector i from a given source point. It is suggested that consideration be given to a separate research effort to develop such a statistical model, as it appears that this may provide a significant enhancement over the present model.

6. REFERENCES

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APPENDIX A

Further Results on Trajectory Statistics

APPENDIX A

Further Results on Trajectory Statistics

Appendix A contains statistics for unweighted, sulphur dioxide weighted, and sulphate weighted trajectories for each source (Sudbury, Baldwin, and CONMJO ALLEG near Pittsburgh, Pennsylvania) for the following periods: 1980, 1979, 1978, January, April, July, October, January 1978, July 1978. The table entries are described in Section 4 of the main text.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1978 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2872.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	2872.	100.0	25.841 ± 0.004	15.531 ± 0.004	0.191	0.219	0.003	4.7
6.	2872.	100.0	25.896 ± 0.007	15.504 ± 0.008	0.372	0.424	0.010	4.2
9.	2872.	100.0	25.952 ± 0.010	15.481 ± 0.011	0.544	0.615	0.019	3.7
12.	2872.	100.0	26.007 ± 0.013	15.457 ± 0.015	0.710	0.795	0.028	3.2
18.	2869.	99.9	26.105 ± 0.019	15.412 ± 0.021	1.019	1.117	0.049	2.7
24.	2864.	99.7	26.182 ± 0.024	15.372 ± 0.026	1.307	1.399	0.088	2.9
30.	2859.	99.5	26.240 ± 0.030	15.338 ± 0.031	1.578	1.648	0.136	3.1
36.	2838.	98.8	26.264 ± 0.034	15.306 ± 0.035	1.814	1.847	0.144	2.5
42.	2794.	97.3	26.249 ± 0.038	15.283 ± 0.038	2.012	1.991	0.104	1.5
48.	2735.	95.2	26.195 ± 0.041	15.263 ± 0.040	2.155	2.103	-0.043	-0.5
54.	2682.	93.4	26.155 ± 0.045	15.259 ± 0.042	2.306	2.181	-0.125	-1.3
60.	2628.	91.5	26.107 ± 0.048	15.243 ± 0.044	2.444	2.263	-0.291	-2.8
66.	2550.	88.8	26.069 ± 0.050	15.224 ± 0.045	2.534	2.284	-0.400	-3.6
72.	2478.	86.3	26.044 ± 0.053	15.200 ± 0.046	2.620	2.298	-0.490	-4.1
78.	2397.	83.5	26.010 ± 0.055	15.198 ± 0.047	2.671	2.289	-0.438	-3.5
84.	2325.	81.0	25.986 ± 0.057	15.239 ± 0.047	2.730	2.286	-0.393	-3.0
90.	2257.	78.6	25.939 ± 0.059	15.284 ± 0.049	2.787	2.309	-0.430	-3.2
96.	2176.	75.8	25.918 ± 0.061	15.324 ± 0.050	2.842	2.316	-0.272	-1.9

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1978 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	7978.269	100.0	2.778	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	6813.723	85.4	2.372	25.838 ± 0.002	15.518 ± 0.003	0.197	0.221	0.003	3.8
6.	5860.128	73.5	2.040	25.891 ± 0.005	15.474 ± 0.006	0.384	0.427	0.009	3.4
9.	5051.955	63.3	1.759	25.944 ± 0.009	15.431 ± 0.009	0.561	0.618	0.015	2.7
12.	4365.656	54.7	1.520	25.997 ± 0.011	15.385 ± 0.012	0.733	0.798	0.017	1.9
18.	3278.923	41.1	1.143	26.093 ± 0.019	15.293 ± 0.020	1.060	1.117	0.012	0.6
24.	2471.919	31.0	0.863	26.164 ± 0.029	15.199 ± 0.028	1.369	1.395	0.021	0.7
30.	1868.545	23.4	0.654	26.217 ± 0.039	15.096 ± 0.038	1.670	1.638	0.037	0.8
36.	1405.589	17.6	0.495	26.238 ± 0.052	14.986 ± 0.049	1.941	1.827	0.028	0.4
42.	1048.333	13.1	0.375	26.198 ± 0.067	14.897 ± 0.061	2.159	1.965	-0.031	-0.4
48.	777.972	9.8	0.284	26.109 ± 0.083	14.815 ± 0.074	2.319	2.058	-0.253	-2.7
54.	579.955	7.3	0.216	26.043 ± 0.103	14.786 ± 0.089	2.480	2.147	-0.357	-3.3
60.	430.662	5.4	0.164	25.949 ± 0.126	14.743 ± 0.108	2.612	2.249	-0.630	-5.3
66.	316.420	4.0	0.124	25.850 ± 0.152	14.708 ± 0.128	2.696	2.283	-0.821	-6.4
72.	233.660	2.9	0.094	25.794 ± 0.182	14.672 ± 0.152	2.779	2.326	-0.977	-7.2
78.	171.618	2.2	0.072	25.695 ± 0.213	14.655 ± 0.177	2.792	2.324	-0.857	-6.3
84.	127.453	1.6	0.055	25.623 ± 0.250	14.675 ± 0.205	2.820	2.315	-0.856	-6.1
90.	95.198	1.2	0.042	25.533 ± 0.293	14.721 ± 0.241	2.862	2.354	-1.049	-7.3
96.	69.985	0.9	0.032	25.448 ± 0.345	14.763 ± 0.285	2.889	2.385	-1.169	-8.0

SOURCE STATION IS: 1 - ONT SUDHURY PERIOD: 1978 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	502.424	100.0	0.175	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	686.724	136.7	0.239	25.848 ± 0.007	15.524 ± 0.009	0.182	0.205	0.004	6.9
6.	846.537	168.5	0.295	25.906 ± 0.012	15.488 ± 0.013	0.353	0.392	0.016	7.1
9.	960.595	191.2	0.334	25.957 ± 0.017	15.446 ± 0.018	0.513	0.563	0.029	6.4
12.	1040.221	207.0	0.362	26.009 ± 0.021	15.400 ± 0.022	0.669	0.722	0.042	5.4
18.	1139.195	226.7	0.397	26.105 ± 0.029	15.299 ± 0.030	0.969	1.008	0.074	4.5
24.	1154.130	229.7	0.403	26.182 ± 0.037	15.168 ± 0.037	1.259	1.261	0.127	4.6
30.	1126.120	224.1	0.394	26.259 ± 0.046	15.020 ± 0.044	1.553	1.473	0.195	4.6
36.	1064.573	211.9	0.375	26.308 ± 0.056	14.867 ± 0.050	1.830	1.632	0.202	3.4
42.	985.142	196.1	0.353	26.307 ± 0.066	14.747 ± 0.055	2.057	1.737	0.135	1.8
48.	889.538	177.0	0.325	26.312 ± 0.075	14.672 ± 0.061	2.240	1.829	-0.029	-0.3
54.	790.816	157.4	0.295	26.370 ± 0.085	14.644 ± 0.069	2.400	1.938	-0.066	-0.7
60.	695.934	138.5	0.265	26.338 ± 0.095	14.590 ± 0.077	2.515	2.036	-0.420	-3.8
66.	598.669	119.2	0.235	26.322 ± 0.107	14.527 ± 0.086	2.610	2.103	-0.617	-5.2
72.	516.197	102.7	0.208	26.384 ± 0.119	14.467 ± 0.096	2.710	2.179	-0.776	-6.0
78.	447.430	89.1	0.187	26.330 ± 0.128	14.447 ± 0.103	2.706	2.184	-0.708	-5.5
84.	391.326	77.9	0.168	26.326 ± 0.138	14.400 ± 0.110	2.737	2.180	-0.887	-6.8
90.	330.558	65.8	0.146	26.313 ± 0.151	14.416 ± 0.123	2.740	2.243	-1.046	-7.9
96.	276.702	55.1	0.127	26.336 ± 0.161	14.440 ± 0.140	2.681	2.335	-1.193	-9.4

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1979 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2886.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	2886.	100.0	25.829 ± 0.004	15.551 ± 0.004	0.214	0.222	0.007	9.1
6.	2886.	100.0	25.871 ± 0.008	15.539 ± 0.008	0.422	0.443	0.026	8.3
9.	2886.	100.0	25.915 ± 0.012	15.525 ± 0.012	0.619	0.663	0.051	7.6
12.	2886.	100.0	25.957 ± 0.015	15.506 ± 0.016	0.800	0.876	0.081	7.2
18.	2875.	99.6	26.021 ± 0.021	15.455 ± 0.023	1.106	1.258	0.156	7.3
24.	2833.	98.2	26.054 ± 0.026	15.437 ± 0.029	1.381	1.552	0.319	9.5
30.	2745.	95.1	26.057 ± 0.031	15.468 ± 0.033	1.620	1.731	0.588	12.6
36.	2638.	91.4	26.021 ± 0.035	15.462 ± 0.036	1.805	1.863	0.883	15.2
42.	2541.	88.0	25.983 ± 0.039	15.450 ± 0.039	1.951	1.952	1.076	15.8
48.	2431.	84.2	25.931 ± 0.042	15.432 ± 0.041	2.069	2.009	1.183	15.5
54.	2314.	80.2	25.857 ± 0.045	15.416 ± 0.042	2.157	2.027	1.196	14.4
60.	2207.	76.5	25.800 ± 0.048	15.439 ± 0.043	2.244	2.026	1.189	13.3
66.	2109.	73.1	25.724 ± 0.050	15.467 ± 0.045	2.297	2.053	1.157	12.4
72.	2002.	69.4	25.636 ± 0.052	15.489 ± 0.046	2.341	2.055	1.114	11.5
78.	1921.	66.6	25.592 ± 0.055	15.497 ± 0.047	2.396	2.060	1.053	10.4
84.	1830.	63.4	25.565 ± 0.057	15.541 ± 0.048	2.428	2.048	1.082	10.4
90.	1747.	60.5	25.528 ± 0.059	15.579 ± 0.049	2.480	2.041	1.029	9.5
96.	1665.	57.7	25.442 ± 0.062	15.608 ± 0.050	2.510	2.056	0.792	7.2

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1979 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8024.939	100.0	2.781	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	6814.926	84.9	2.361	25.821 ± 0.003	15.546 ± 0.003	0.227	0.231	0.008	8.8
6.	5840.980	72.8	2.024	25.860 ± 0.006	15.526 ± 0.006	0.443	0.462	0.028	8.2
9.	5027.015	62.6	1.742	25.903 ± 0.009	15.497 ± 0.010	0.645	0.691	0.055	7.5
12.	4339.950	54.1	1.504	25.946 ± 0.013	15.461 ± 0.014	0.833	0.915	0.084	6.9
18.	3245.421	40.4	1.129	26.010 ± 0.020	15.371 ± 0.023	1.151	1.321	0.153	6.6
24.	2391.688	29.8	0.844	26.029 ± 0.029	15.333 ± 0.033	1.439	1.622	0.326	8.9
30.	1732.439	21.6	0.631	25.989 ± 0.040	15.355 ± 0.044	1.694	1.816	0.631	12.5
36.	1256.564	15.7	0.476	25.919 ± 0.053	15.345 ± 0.055	1.879	1.956	0.948	15.0
42.	915.195	11.4	0.360	25.844 ± 0.067	15.341 ± 0.068	2.024	2.055	1.145	15.6
48.	664.368	8.3	0.273	25.746 ± 0.083	15.330 ± 0.083	2.133	2.129	1.259	15.5
54.	481.894	6.0	0.208	25.646 ± 0.101	15.337 ± 0.098	2.221	2.143	1.246	14.2
60.	350.272	4.4	0.159	25.570 ± 0.124	15.388 ± 0.113	2.320	2.123	1.267	13.2
66.	255.078	3.2	0.121	25.469 ± 0.149	15.435 ± 0.135	2.380	2.150	1.245	12.4
72.	184.806	2.3	0.092	25.361 ± 0.180	15.479 ± 0.161	2.453	2.182	1.281	12.0
78.	134.283	1.7	0.070	25.275 ± 0.216	15.488 ± 0.189	2.508	2.194	1.200	10.8
84.	97.573	1.2	0.053	25.204 ± 0.258	15.553 ± 0.224	2.544	2.209	1.233	10.8
90.	70.419	0.9	0.040	25.105 ± 0.310	15.587 ± 0.260	2.603	2.185	1.174	9.8
96.	51.264	0.6	0.031	24.986 ± 0.369	15.629 ± 0.307	2.641	2.201	0.966	7.9

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1979 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	504.876	100.0	0.175	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	657.717	130.3	0.228	25.837 ± 0.008	15.547 ± 0.009	0.207	0.213	0.008	10.5
6.	811.375	160.7	0.281	25.893 ± 0.014	15.525 ± 0.015	0.397	0.419	0.030	10.9
9.	927.494	183.7	0.321	25.951 ± 0.019	15.490 ± 0.020	0.574	0.618	0.059	10.1
12.	1015.409	201.1	0.352	26.008 ± 0.023	15.455 ± 0.026	0.739	0.815	0.089	9.2
18.	1116.079	221.1	0.388	26.110 ± 0.031	15.366 ± 0.035	1.022	1.173	0.163	8.8
24.	1100.887	218.1	0.389	26.162 ± 0.039	15.272 ± 0.043	1.288	1.436	0.285	9.7
30.	1034.369	204.9	0.377	26.167 ± 0.048	15.230 ± 0.050	1.529	1.621	0.552	13.3
36.	957.008	189.6	0.363	26.145 ± 0.056	15.186 ± 0.057	1.725	1.757	0.840	15.8
42.	863.647	171.1	0.340	26.132 ± 0.065	15.150 ± 0.063	1.902	1.866	1.126	17.3
48.	775.352	153.6	0.319	26.117 ± 0.075	15.145 ± 0.070	2.080	1.941	1.387	17.8
54.	682.173	135.1	0.295	26.074 ± 0.086	15.177 ± 0.076	2.245	1.988	1.556	17.2
60.	591.913	117.2	0.268	26.036 ± 0.098	15.208 ± 0.083	2.389	2.012	1.767	17.2
66.	501.957	99.4	0.238	25.939 ± 0.112	15.238 ± 0.092	2.507	2.057	1.821	16.2
72.	414.908	82.2	0.207	25.846 ± 0.127	15.236 ± 0.103	2.586	2.102	1.778	14.9
78.	350.126	69.3	0.182	25.797 ± 0.144	15.240 ± 0.112	2.693	2.099	1.772	13.7
84.	292.429	57.9	0.160	25.723 ± 0.161	15.262 ± 0.122	2.749	2.089	1.711	12.8
90.	243.204	48.2	0.139	25.666 ± 0.181	15.211 ± 0.132	2.829	2.052	1.832	12.9
96.	198.883	39.4	0.119	25.584 ± 0.201	15.174 ± 0.149	2.841	2.106	1.766	12.3

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1980 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2894.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	2894.	100.0	25.840 ± 0.004	15.521 ± 0.004	0.196	0.220	0.004	5.9
6.	2894.	100.0	25.890 ± 0.007	15.485 ± 0.008	0.390	0.436	0.013	5.0
9.	2894.	100.0	25.939 ± 0.011	15.451 ± 0.012	0.579	0.642	0.029	4.9
12.	2894.	100.0	25.981 ± 0.014	15.419 ± 0.016	0.757	0.836	0.054	5.4
18.	2879.	99.5	26.035 ± 0.020	15.374 ± 0.022	1.059	1.172	0.164	8.3
24.	2855.	98.7	26.056 ± 0.025	15.333 ± 0.027	1.329	1.444	0.318	10.2
30.	2794.	96.5	26.022 ± 0.029	15.272 ± 0.031	1.547	1.646	0.417	9.9
36.	2729.	94.3	25.960 ± 0.033	15.231 ± 0.035	1.747	1.816	0.539	10.0
42.	2653.	91.7	25.880 ± 0.037	15.180 ± 0.038	1.919	1.945	0.644	9.9
48.	2552.	88.2	25.791 ± 0.041	15.132 ± 0.040	2.066	2.022	0.762	10.1
54.	2435.	84.1	25.678 ± 0.044	15.066 ± 0.042	2.169	2.060	0.853	10.3
60.	2340.	80.9	25.579 ± 0.046	15.038 ± 0.043	2.235	2.093	0.839	9.5
66.	2244.	77.5	25.508 ± 0.048	15.042 ± 0.044	2.287	2.097	0.740	8.1
72.	2158.	74.6	25.461 ± 0.051	15.014 ± 0.045	2.348	2.091	0.660	6.8
78.	2065.	71.4	25.416 ± 0.052	15.024 ± 0.046	2.372	2.110	0.516	5.2
84.	1980.	68.4	25.393 ± 0.054	15.065 ± 0.048	2.422	2.150	0.484	4.7
90.	1873.	64.7	25.356 ± 0.057	15.119 ± 0.050	2.452	2.154	0.376	3.6
96.	1794.	62.0	25.338 ± 0.059	15.141 ± 0.052	2.504	2.182	0.332	3.0

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1980 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8057.893	100.0	2.784	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	6828.462	84.7	2.360	25.838 ± 0.002	15.517 ± 0.003	0.200	0.227	0.004	5.8
6.	5834.457	72.4	2.016	25.886 ± 0.005	15.474 ± 0.006	0.395	0.446	0.014	5.0
9.	5009.271	62.2	1.731	25.929 ± 0.008	15.429 ± 0.009	0.583	0.652	0.028	4.7
12.	4316.720	53.6	1.492	25.967 ± 0.012	15.382 ± 0.013	0.762	0.843	0.050	4.9
18.	3214.503	39.9	1.117	26.011 ± 0.019	15.296 ± 0.021	1.068	1.165	0.147	7.4
24.	2403.194	29.8	0.842	26.022 ± 0.027	15.210 ± 0.029	1.342	1.442	0.290	9.1
30.	1778.052	22.1	0.636	25.973 ± 0.037	15.112 ± 0.039	1.579	1.657	0.417	9.5
36.	1307.698	16.2	0.479	25.868 ± 0.049	15.020 ± 0.051	1.783	1.835	0.549	9.8
42.	959.374	11.9	0.362	25.730 ± 0.063	14.919 ± 0.064	1.958	1.967	0.680	10.1
48.	700.105	8.7	0.274	25.585 ± 0.080	14.836 ± 0.077	2.123	2.044	0.799	10.0
54.	507.751	6.3	0.209	25.399 ± 0.099	14.724 ± 0.092	2.236	2.071	0.786	8.9
60.	371.038	4.6	0.159	25.216 ± 0.119	14.688 ± 0.110	2.288	2.113	0.659	7.2
66.	270.858	3.4	0.121	25.087 ± 0.142	14.701 ± 0.129	2.333	2.119	0.368	3.9
72.	198.160	2.5	0.092	24.982 ± 0.170	14.657 ± 0.149	2.397	2.103	0.140	1.4
78.	144.148	1.8	0.070	24.882 ± 0.200	14.674 ± 0.177	2.403	2.130	-0.124	-1.2
84.	105.800	1.3	0.053	24.810 ± 0.237	14.723 ± 0.213	2.439	2.188	-0.240	-2.3
90.	77.066	1.0	0.041	24.769 ± 0.281	14.796 ± 0.253	2.470	2.220	-0.351	-3.3
96.	56.765	0.7	0.032	24.756 ± 0.337	14.821 ± 0.301	2.536	2.268	-0.409	-3.6

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 1980 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	506.405	100.0	0.175	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	647.363	127.8	0.224	25.847 ± 0.007	15.516 ± 0.008	0.186	0.208	0.006	9.2
6.	785.312	155.1	0.271	25.899 ± 0.013	15.468 ± 0.014	0.365	0.406	0.022	9.3
9.	889.593	175.7	0.307	25.944 ± 0.019	15.405 ± 0.020	0.540	0.588	0.044	8.5
12.	968.167	191.2	0.335	25.988 ± 0.023	15.339 ± 0.024	0.711	0.759	0.074	8.1
18.	1057.328	208.8	0.367	26.053 ± 0.031	15.207 ± 0.032	1.006	1.051	0.159	8.9
24.	1071.425	211.6	0.375	26.090 ± 0.039	15.084 ± 0.040	1.270	1.320	0.280	9.9
30.	1041.299	205.6	0.373	26.099 ± 0.047	14.954 ± 0.046	1.507	1.496	0.418	10.4
36.	973.424	192.2	0.357	26.068 ± 0.055	14.861 ± 0.053	1.720	1.657	0.551	10.6
42.	902.376	178.2	0.340	26.008 ± 0.064	14.800 ± 0.060	1.930	1.798	0.669	10.2
48.	806.948	159.3	0.316	25.915 ± 0.075	14.740 ± 0.067	2.144	1.892	0.723	8.9
54.	697.723	137.8	0.287	25.769 ± 0.087	14.656 ± 0.073	2.291	1.918	0.610	6.6
60.	598.520	118.2	0.256	25.613 ± 0.096	14.632 ± 0.081	2.341	1.972	0.458	4.8
66.	511.043	100.9	0.228	25.533 ± 0.107	14.591 ± 0.087	2.414	1.965	0.298	2.9
72.	433.968	85.7	0.201	25.427 ± 0.120	14.522 ± 0.094	2.493	1.952	0.124	1.1
78.	364.439	72.0	0.176	25.321 ± 0.133	14.537 ± 0.106	2.532	2.027	-0.131	-1.2
84.	308.026	60.8	0.156	25.194 ± 0.146	14.585 ± 0.119	2.555	2.097	-0.177	-1.6
90.	258.494	51.0	0.138	25.142 ± 0.159	14.650 ± 0.134	2.551	2.147	-0.184	-1.6
96.	213.947	42.2	0.119	25.153 ± 0.178	14.597 ± 0.150	2.601	2.200	-0.093	-0.8

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: JAN HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	738.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	738.	100.0	25.817 ± 0.010	15.472 ± 0.011	0.262	0.287	-0.005	-4.4
6.	738.	100.0	25.860 ± 0.018	15.377 ± 0.020	0.502	0.553	-0.028	-6.2
9.	738.	100.0	25.918 ± 0.027	15.272 ± 0.030	0.729	0.802	-0.071	-7.6
12.	738.	100.0	25.985 ± 0.035	15.157 ± 0.038	0.943	1.038	-0.129	-8.2
18.	733.	99.3	26.105 ± 0.048	14.913 ± 0.054	1.305	1.465	-0.206	-8.9
24.	706.	95.7	26.163 ± 0.061	14.759 ± 0.067	1.616	1.782	-0.103	-2.3
30.	664.	90.0	26.186 ± 0.073	14.705 ± 0.077	1.890	1.978	-0.051	-0.8
36.	632.	85.6	26.158 ± 0.084	14.568 ± 0.086	2.124	2.156	0.075	1.0
42.	595.	80.6	26.033 ± 0.094	14.432 ± 0.097	2.289	2.355	0.372	4.1
48.	558.	75.6	25.839 ± 0.102	14.309 ± 0.105	2.411	2.512	0.654	6.4
54.	519.	70.3	25.611 ± 0.111	14.203 ± 0.111	2.535	2.527	0.708	6.3
60.	482.	65.3	25.365 ± 0.123	14.205 ± 0.114	2.693	2.511	0.641	5.0
66.	462.	62.6	25.155 ± 0.129	14.259 ± 0.117	2.782	2.518	0.377	2.8
72.	446.	60.4	24.948 ± 0.135	14.330 ± 0.118	2.849	2.484	0.097	0.7
78.	429.	58.1	24.733 ± 0.139	14.458 ± 0.119	2.883	2.475	-0.231	-1.6
84.	408.	55.3	24.600 ± 0.144	14.616 ± 0.124	2.906	2.505	-0.518	-3.5
90.	385.	52.2	24.490 ± 0.149	14.775 ± 0.131	2.923	2.567	-1.049	-7.0
96.	359.	48.6	24.415 ± 0.153	14.797 ± 0.135	2.900	2.566	-1.540	-10.4

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: JAN HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	3039.960	100.0	4.119	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	2624.983	86.3	3.557	25.819 ± 0.005	15.472 ± 0.006	0.260	0.283	-0.006	-4.9
6.	2273.880	74.8	3.081	25.865 ± 0.010	15.380 ± 0.011	0.495	0.539	-0.029	-6.7
9.	1975.251	65.0	2.676	25.925 ± 0.016	15.280 ± 0.017	0.717	0.774	-0.068	-7.6
12.	1720.599	56.6	2.331	25.995 ± 0.022	15.170 ± 0.024	0.925	0.997	-0.119	-7.9
18.	1299.393	42.7	1.773	26.120 ± 0.035	14.936 ± 0.039	1.279	1.401	-0.193	-5.7
24.	953.171	31.4	1.350	26.178 ± 0.051	14.798 ± 0.055	1.581	1.684	-0.124	-2.8
30.	690.161	22.7	1.039	26.186 ± 0.071	14.733 ± 0.072	1.856	1.885	-0.034	-0.6
36.	503.455	16.6	0.797	26.150 ± 0.093	14.589 ± 0.092	2.088	2.054	0.063	0.8
42.	363.367	12.0	0.611	26.023 ± 0.119	14.457 ± 0.118	2.259	2.251	0.355	4.0
48.	262.953	8.6	0.471	25.866 ± 0.149	14.349 ± 0.149	2.419	2.418	0.711	6.9
54.	187.857	6.2	0.362	25.650 ± 0.186	14.236 ± 0.178	2.552	2.443	0.731	6.4
60.	133.041	4.4	0.276	25.407 ± 0.235	14.240 ± 0.211	2.710	2.436	0.626	4.9
66.	96.584	3.2	0.209	25.192 ± 0.285	14.287 ± 0.249	2.799	2.447	0.286	2.1
72.	70.732	2.3	0.159	24.982 ± 0.341	14.343 ± 0.287	2.865	2.416	-0.029	-0.2
78.	51.588	1.7	0.120	24.730 ± 0.399	14.435 ± 0.335	2.864	2.408	-0.305	-2.1
84.	37.443	1.2	0.092	24.596 ± 0.471	14.537 ± 0.395	2.879	2.420	-0.586	-4.0
90.	27.002	0.9	0.070	24.508 ± 0.555	14.656 ± 0.473	2.885	2.455	-1.169	-8.0
96.	19.369	0.6	0.054	24.447 ± 0.553	14.695 ± 0.559	2.873	2.455	-1.746	-11.9

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: JAN HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	141.029	100.0	0.191	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	176.135	124.9	0.239	25.825 ± 0.019	15.473 ± 0.020	0.250	0.263	-0.007	-6.2
6.	207.885	147.4	0.282	25.872 ± 0.033	15.379 ± 0.034	0.472	0.484	-0.025	-6.3
9.	234.281	166.1	0.317	25.935 ± 0.044	15.279 ± 0.045	0.680	0.684	-0.049	-6.0
12.	254.856	180.7	0.345	26.014 ± 0.055	15.171 ± 0.055	0.878	0.881	-0.084	-6.2
18.	279.989	198.5	0.382	26.168 ± 0.073	14.942 ± 0.074	1.230	1.241	-0.141	-5.3
24.	281.073	199.3	0.398	26.257 ± 0.091	14.795 ± 0.089	1.532	1.489	-0.048	-1.2
30.	268.259	190.2	0.404	26.284 ± 0.111	14.694 ± 0.105	1.812	1.713	0.120	2.1
36.	248.596	176.3	0.393	26.264 ± 0.130	14.508 ± 0.120	2.047	1.888	0.222	3.0
42.	223.795	158.7	0.376	26.139 ± 0.149	14.367 ± 0.140	2.235	2.098	0.483	5.5
48.	201.904	143.2	0.362	25.979 ± 0.170	14.271 ± 0.159	2.419	2.263	0.733	7.1
54.	179.150	127.0	0.345	25.775 ± 0.194	14.183 ± 0.172	2.590	2.301	0.718	6.1
60.	155.907	110.5	0.323	25.579 ± 0.222	14.206 ± 0.186	2.769	2.328	0.485	3.6
66.	138.537	98.2	0.300	25.389 ± 0.242	14.237 ± 0.199	2.850	2.345	-0.029	-0.2
72.	122.665	87.0	0.275	25.221 ± 0.263	14.266 ± 0.211	2.913	2.334	-0.367	-2.5
78.	104.194	73.9	0.243	24.950 ± 0.282	14.284 ± 0.224	2.876	2.289	-0.593	-4.1
84.	90.449	64.1	0.222	24.858 ± 0.302	14.314 ± 0.238	2.869	2.261	-0.862	-6.0
90.	78.209	55.5	0.203	24.895 ± 0.329	14.359 ± 0.253	2.910	2.238	-1.413	-9.5
96.	69.140	49.0	0.193	24.908 ± 0.355	14.421 ± 0.273	2.949	2.267	-1.705	-11.1

SOURCE STATION IS: 1 - ONT SUDHURY PERIOD: APR HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	720.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	720.	100.0	25.722 ± 0.007	15.517 ± 0.010	0.194	0.257	-0.006	-9.4
6.	720.	100.0	25.660 ± 0.015	15.473 ± 0.018	0.390	0.490	-0.030	-11.0
9.	720.	100.0	25.606 ± 0.021	15.429 ± 0.026	0.576	0.696	-0.064	-11.0
12.	720.	100.0	25.556 ± 0.028	15.382 ± 0.033	0.751	0.886	-0.098	-9.9
18.	716.	99.4	25.448 ± 0.038	15.293 ± 0.046	1.020	1.233	-0.122	-6.7
24.	711.	98.8	25.332 ± 0.047	15.218 ± 0.058	1.245	1.547	-0.125	-4.6
30.	698.	96.9	25.194 ± 0.054	15.137 ± 0.066	1.421	1.741	-0.099	-2.8
36.	684.	95.0	25.052 ± 0.059	15.052 ± 0.071	1.553	1.857	-0.136	-3.2
42.	673.	93.5	24.936 ± 0.063	14.999 ± 0.075	1.694	1.942	-0.168	-3.4
48.	667.	92.6	24.860 ± 0.072	14.971 ± 0.079	1.858	2.037	-0.226	-3.7
54.	652.	90.6	24.723 ± 0.075	14.939 ± 0.083	1.923	2.127	-0.391	-5.0
60.	642.	89.2	24.635 ± 0.079	14.923 ± 0.088	2.003	2.227	-0.486	-6.9
66.	629.	87.4	24.580 ± 0.084	14.907 ± 0.091	2.099	2.287	-0.579	-7.5
72.	606.	84.2	24.491 ± 0.089	14.852 ± 0.092	2.180	2.255	-0.813	-9.7
78.	594.	82.5	24.414 ± 0.093	14.926 ± 0.094	2.270	2.292	-1.072	-11.7
84.	576.	80.0	24.289 ± 0.096	15.044 ± 0.098	2.302	2.359	-1.408	-14.9
90.	558.	77.5	24.187 ± 0.100	15.239 ± 0.101	2.360	2.387	-1.610	-16.1
96.	528.	73.3	24.079 ± 0.104	15.320 ± 0.104	2.401	2.379	-1.847	-17.8

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: APR HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1834.524	100.0	2.548	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	1528.337	83.3	2.123	25.724 ± 0.005	15.510 ± 0.007	0.191	0.256	-0.005	-8.3
6.	1295.309	70.6	1.799	25.669 ± 0.010	15.452 ± 0.013	0.375	0.486	-0.023	-9.3
9.	1110.865	60.6	1.543	25.624 ± 0.016	15.392 ± 0.021	0.544	0.689	-0.050	-9.6
12.	961.579	52.4	1.336	25.582 ± 0.023	15.337 ± 0.028	0.705	0.878	-0.082	-9.4
18.	725.553	39.5	1.013	25.484 ± 0.035	15.251 ± 0.045	0.955	1.210	-0.124	-7.8
24.	549.881	30.0	0.773	25.364 ± 0.050	15.179 ± 0.064	1.175	1.490	-0.173	-7.1
30.	414.961	22.6	0.595	25.197 ± 0.066	15.103 ± 0.081	1.348	1.643	-0.183	-5.7
36.	315.874	17.2	0.462	25.030 ± 0.085	15.029 ± 0.098	1.512	1.735	-0.211	-5.3
42.	239.747	13.1	0.356	24.945 ± 0.106	14.974 ± 0.116	1.645	1.790	-0.274	-5.8
48.	184.266	10.0	0.276	24.690 ± 0.132	14.944 ± 0.138	1.793	1.871	-0.401	-7.1
54.	140.859	7.7	0.216	24.509 ± 0.159	14.929 ± 0.167	1.882	1.976	-0.573	-9.2
60.	107.954	5.9	0.168	24.375 ± 0.190	14.910 ± 0.201	1.975	2.085	-0.709	-10.3
66.	83.040	4.5	0.132	24.272 ± 0.229	14.934 ± 0.241	2.085	2.192	-0.875	-11.4
72.	62.480	3.4	0.103	24.137 ± 0.274	14.919 ± 0.280	2.164	2.215	-1.131	-13.6
78.	47.845	2.6	0.081	24.028 ± 0.323	15.029 ± 0.334	2.251	2.313	-1.458	-16.0
84.	36.159	2.0	0.063	23.858 ± 0.373	15.146 ± 0.402	2.254	2.420	-1.921	-20.7
90.	27.124	1.5	0.049	23.710 ± 0.442	15.355 ± 0.478	2.302	2.487	-2.209	-22.6
96.	19.714	1.1	0.037	23.572 ± 0.531	15.421 ± 0.563	2.357	2.498	-2.684	-25.9

SOURCE STATION IS: 1 - ONT SUDHURY PERIOD: APR HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	114.658	100.0	0.159	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	129.307	112.8	0.180	25.729 ± 0.016	15.498 ± 0.022	0.178	0.249	-0.002	-3.4
6.	157.144	137.1	0.218	25.679 ± 0.027	15.429 ± 0.037	0.339	0.469	-0.006	-2.8
9.	182.807	159.4	0.254	25.635 ± 0.036	15.365 ± 0.049	0.486	0.666	-0.015	-3.5
12.	202.620	176.7	0.281	25.590 ± 0.044	15.313 ± 0.060	0.628	0.850	-0.040	-5.8
18.	224.640	195.9	0.314	25.496 ± 0.057	15.187 ± 0.077	0.859	1.156	-0.090	-7.0
24.	233.797	203.9	0.329	25.368 ± 0.070	15.079 ± 0.093	1.063	1.418	-0.186	-9.3
30.	229.903	200.5	0.329	25.196 ± 0.082	14.957 ± 0.101	1.248	1.536	-0.270	-9.8
36.	222.903	194.4	0.326	25.002 ± 0.096	14.865 ± 0.107	1.437	1.604	-0.396	-10.8
42.	207.719	181.2	0.309	24.749 ± 0.108	14.834 ± 0.116	1.559	1.676	-0.533	-12.4
48.	193.745	169.0	0.290	24.547 ± 0.124	14.890 ± 0.129	1.726	1.797	-0.769	-14.5
54.	177.250	154.6	0.272	24.374 ± 0.142	14.958 ± 0.146	1.890	1.945	-0.939	-14.7
60.	159.488	139.1	0.248	24.274 ± 0.160	14.928 ± 0.162	2.020	2.048	-1.202	-16.4
66.	139.313	121.5	0.221	24.230 ± 0.183	14.849 ± 0.181	2.160	2.137	-1.426	-17.0
72.	115.292	100.6	0.190	24.155 ± 0.205	14.726 ± 0.201	2.208	2.157	-1.798	-20.2
78.	101.692	88.7	0.171	24.103 ± 0.226	14.830 ± 0.226	2.276	2.276	-2.445	-25.3
84.	86.283	75.3	0.150	23.937 ± 0.242	14.848 ± 0.257	2.247	2.388	-3.351	-33.6
90.	70.488	61.5	0.126	23.834 ± 0.267	15.009 ± 0.297	2.238	2.490	-3.786	-37.1
96.	59.895	52.2	0.113	23.936 ± 0.310	15.088 ± 0.345	2.402	2.467	-4.270	-36.5

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: JUL HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	744.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	744.	100.0	25.864 ± 0.005	15.527 ± 0.005	0.124	0.129	0.007	24.5
6.	744.	100.0	25.938 ± 0.009	15.496 ± 0.009	0.243	0.258	0.029	25.1
9.	744.	100.0	26.012 ± 0.013	15.468 ± 0.014	0.358	0.385	0.061	25.5
12.	744.	100.0	26.084 ± 0.017	15.444 ± 0.019	0.467	0.509	0.106	25.9
18.	744.	100.0	26.216 ± 0.024	15.409 ± 0.027	0.664	0.737	0.220	26.5
24.	744.	100.0	26.337 ± 0.031	15.390 ± 0.035	0.846	0.946	0.360	26.7
30.	744.	100.0	26.452 ± 0.037	15.386 ± 0.042	1.020	1.135	0.521	26.6
36.	741.	99.6	26.557 ± 0.044	15.382 ± 0.047	1.185	1.277	0.662	25.2
42.	738.	99.2	26.670 ± 0.050	15.394 ± 0.051	1.354	1.385	0.785	23.2
48.	729.	98.0	26.772 ± 0.056	15.403 ± 0.053	1.501	1.441	0.859	20.9
54.	717.	96.4	26.866 ± 0.060	15.437 ± 0.056	1.613	1.507	0.982	20.7
60.	707.	95.0	26.972 ± 0.065	15.476 ± 0.059	1.716	1.566	1.096	20.4
66.	697.	93.7	27.077 ± 0.068	15.527 ± 0.062	1.799	1.635	1.172	19.9
72.	673.	90.5	27.158 ± 0.072	15.531 ± 0.062	1.863	1.616	1.203	19.1
78.	656.	88.2	27.260 ± 0.075	15.584 ± 0.063	1.923	1.625	1.274	19.0
84.	636.	85.5	27.337 ± 0.078	15.670 ± 0.065	1.960	1.641	1.345	19.3
90.	621.	83.5	27.409 ± 0.080	15.736 ± 0.068	1.986	1.687	1.355	19.0
96.	603.	81.0	27.486 ± 0.081	15.793 ± 0.070	1.998	1.725	1.439	19.8

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: JUL HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1484.945	100.0	1.996	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	1219.032	82.1	1.638	25.864 ± 0.004	15.526 ± 0.004	0.122	0.129	0.007	24.5
6.	1007.924	67.9	1.355	25.938 ± 0.008	15.491 ± 0.008	0.239	0.258	0.027	24.9
9.	837.654	56.4	1.126	26.009 ± 0.012	15.457 ± 0.013	0.351	0.384	0.058	25.1
12.	699.171	47.1	0.940	26.077 ± 0.017	15.425 ± 0.019	0.458	0.506	0.099	25.2
18.	488.592	32.9	0.657	26.201 ± 0.030	15.364 ± 0.033	0.656	0.729	0.203	25.2
24.	340.661	22.9	0.458	26.307 ± 0.046	15.301 ± 0.050	0.845	0.922	0.323	24.4
30.	237.544	16.0	0.319	26.405 ± 0.067	15.240 ± 0.070	1.031	1.081	0.445	22.7
36.	166.587	11.2	0.225	26.510 ± 0.095	15.190 ± 0.092	1.221	1.192	0.560	20.6
42.	117.443	7.9	0.159	26.640 ± 0.131	15.165 ± 0.117	1.424	1.267	0.688	18.8
48.	82.138	5.5	0.113	26.776 ± 0.179	15.157 ± 0.143	1.621	1.299	0.827	17.5
54.	56.849	3.8	0.079	26.877 ± 0.232	15.177 ± 0.179	1.753	1.347	0.999	18.0
60.	39.610	2.7	0.056	26.977 ± 0.297	15.209 ± 0.222	1.869	1.395	1.146	18.2
66.	27.558	1.9	0.040	27.066 ± 0.377	15.242 ± 0.275	1.978	1.441	1.238	17.6
72.	18.942	1.3	0.028	27.138 ± 0.477	15.261 ± 0.334	2.075	1.453	1.305	16.9
78.	12.994	0.9	0.020	27.208 ± 0.599	15.306 ± 0.407	2.159	1.469	1.381	16.5
84.	8.733	0.6	0.014	27.228 ± 0.751	15.359 ± 0.500	2.219	1.478	1.477	16.7
90.	5.902	0.4	0.010	27.253 ± 0.938	15.390 ± 0.621	2.279	1.507	1.532	16.4
96.	3.877	0.3	0.006	27.255 ± 1.175	15.387 ± 0.770	2.313	1.515	1.533	16.0

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: JUL HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	142.176	100.0	0.191	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	215.956	151.9	0.290	25.867 ± 0.008	15.525 ± 0.009	0.120	0.129	0.007	24.7
6.	274.887	193.3	0.369	25.941 ± 0.014	15.486 ± 0.016	0.234	0.257	0.026	25.1
9.	319.766	224.9	0.430	26.010 ± 0.019	15.443 ± 0.021	0.345	0.383	0.056	25.1
12.	351.233	247.0	0.472	26.076 ± 0.024	15.399 ± 0.027	0.452	0.503	0.097	25.3
18.	388.904	273.5	0.523	26.192 ± 0.033	15.300 ± 0.036	0.654	0.711	0.192	24.2
24.	387.374	272.5	0.521	26.276 ± 0.043	15.183 ± 0.044	0.847	0.871	0.279	21.2
30.	376.652	264.9	0.506	26.351 ± 0.054	15.069 ± 0.050	1.039	0.975	0.331	17.1
36.	359.335	252.7	0.485	26.473 ± 0.066	14.996 ± 0.055	1.257	1.047	0.452	16.0
42.	339.271	238.6	0.460	26.625 ± 0.081	14.948 ± 0.058	1.494	1.072	0.616	15.4
48.	308.319	216.9	0.423	26.817 ± 0.100	14.952 ± 0.061	1.754	1.073	0.900	16.3
54.	272.243	191.5	0.380	26.933 ± 0.116	14.977 ± 0.059	1.915	1.136	1.125	17.1
60.	242.379	170.5	0.343	27.017 ± 0.132	15.025 ± 0.076	2.055	1.182	1.279	16.9
66.	210.726	148.2	0.302	27.052 ± 0.152	15.029 ± 0.083	2.208	1.198	1.357	15.6
72.	183.383	129.0	0.272	27.130 ± 0.173	15.040 ± 0.091	2.344	1.226	1.492	15.2
78.	155.511	109.4	0.237	27.115 ± 0.200	15.091 ± 0.101	2.490	1.257	1.600	14.5
84.	127.062	89.4	0.200	26.940 ± 0.231	15.058 ± 0.110	2.608	1.241	1.674	13.8
90.	105.428	74.2	0.170	26.883 ± 0.263	15.053 ± 0.122	2.705	1.258	1.683	13.0
96.	79.637	56.0	0.132	26.845 ± 0.306	14.998 ± 0.135	2.731	1.205	1.582	12.0

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: OCT HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	744.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	744.	100.0	25.887 ± 0.006	15.557 ± 0.008	0.170	0.231	0.003	6.4
6.	744.	100.0	25.987 ± 0.013	15.563 ± 0.017	0.347	0.457	0.007	3.5
9.	744.	100.0	26.085 ± 0.019	15.577 ± 0.025	0.528	0.672	0.009	1.9
12.	744.	100.0	26.176 ± 0.026	15.595 ± 0.032	0.702	0.874	0.009	1.1
18.	737.	99.1	26.311 ± 0.036	15.635 ± 0.045	0.972	1.230	0.054	3.3
24.	730.	98.1	26.434 ± 0.046	15.654 ± 0.057	1.236	1.530	0.091	3.4
30.	707.	95.0	26.509 ± 0.054	15.649 ± 0.066	1.447	1.753	0.089	2.4
36.	669.	89.9	26.530 ± 0.063	15.620 ± 0.073	1.640	1.888	0.138	2.9
42.	641.	86.2	26.543 ± 0.072	15.540 ± 0.080	1.823	2.016	0.166	2.9
48.	601.	80.8	26.471 ± 0.080	15.471 ± 0.085	1.969	2.094	0.294	4.3
54.	567.	76.2	26.387 ± 0.089	15.430 ± 0.090	2.115	2.137	0.612	7.8
60.	540.	72.6	26.272 ± 0.095	15.330 ± 0.093	2.204	2.168	0.721	8.4
66.	509.	68.4	26.125 ± 0.100	15.177 ± 0.095	2.250	2.148	0.671	7.5
72.	488.	65.6	26.037 ± 0.104	15.018 ± 0.097	2.302	2.149	0.720	7.7
78.	467.	62.8	25.927 ± 0.107	14.838 ± 0.099	2.308	2.130	0.679	7.3
84.	448.	60.2	25.899 ± 0.110	14.765 ± 0.099	2.338	2.103	0.805	8.4
90.	426.	57.3	25.790 ± 0.115	14.677 ± 0.101	2.365	2.088	0.993	10.1
96.	407.	54.7	25.680 ± 0.118	14.592 ± 0.103	2.378	2.069	1.013	10.1

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: OCT HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1895.675	100.0	2.548	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	1588.457	83.8	2.135	25.889 ± 0.004	15.558 ± 0.006	0.170	0.229	0.004	7.1
6.	1341.188	70.7	1.803	25.989 ± 0.009	15.565 ± 0.012	0.347	0.451	0.011	5.1
9.	1135.314	59.9	1.526	26.087 ± 0.016	15.574 ± 0.020	0.529	0.658	0.017	3.5
12.	962.373	50.8	1.294	26.176 ± 0.023	15.578 ± 0.027	0.703	0.849	0.026	3.0
18.	691.601	36.5	0.938	26.319 ± 0.037	15.588 ± 0.045	0.973	1.193	0.092	5.5
24.	499.890	26.4	0.685	26.445 ± 0.055	15.581 ± 0.066	1.228	1.485	0.128	4.9
30.	356.020	18.8	0.504	26.513 ± 0.075	15.561 ± 0.091	1.422	1.711	0.082	2.3
36.	249.857	13.2	0.373	26.556 ± 0.103	15.508 ± 0.117	1.630	1.853	0.113	2.4
42.	174.813	9.2	0.273	26.565 ± 0.135	15.400 ± 0.149	1.785	1.976	0.134	2.4
48.	122.418	6.5	0.204	26.581 ± 0.175	15.330 ± 0.188	1.940	2.082	0.289	4.4
54.	85.524	4.5	0.151	26.588 ± 0.225	15.270 ± 0.234	2.085	2.165	0.595	7.8
60.	59.279	3.1	0.110	26.479 ± 0.278	15.177 ± 0.294	2.139	2.260	0.711	8.8
66.	40.889	2.2	0.080	26.358 ± 0.338	14.976 ± 0.358	2.159	2.288	0.628	7.7
72.	29.040	1.5	0.060	26.322 ± 0.408	14.718 ± 0.426	2.198	2.298	0.632	7.5
78.	20.895	1.1	0.045	26.226 ± 0.472	14.497 ± 0.491	2.156	2.244	0.569	7.0
84.	15.594	0.8	0.035	26.239 ± 0.547	14.430 ± 0.568	2.159	2.243	0.780	9.5
90.	11.383	0.6	0.027	26.148 ± 0.650	14.359 ± 0.657	2.193	2.217	0.977	11.5
96.	8.221	0.4	0.020	26.001 ± 0.772	14.280 ± 0.752	2.214	2.156	0.844	9.8

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: OCT HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	118.480	100.0	0.159	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	134.613	113.6	0.181	25.896 ± 0.015	15.572 ± 0.019	0.169	0.220	0.005	10.8
6.	153.841	129.8	0.207	25.994 ± 0.027	15.599 ± 0.035	0.338	0.431	0.020	10.1
9.	163.121	137.7	0.219	26.076 ± 0.040	15.590 ± 0.048	0.517	0.616	0.026	5.5
12.	168.261	142.0	0.226	26.158 ± 0.053	15.559 ± 0.061	0.690	0.785	0.030	3.6
18.	165.363	139.6	0.224	26.304 ± 0.075	15.502 ± 0.087	0.961	1.124	0.085	5.2
24.	153.414	129.5	0.210	26.433 ± 0.097	15.385 ± 0.112	1.202	1.393	0.103	4.1
30.	135.857	114.7	0.192	26.517 ± 0.118	15.265 ± 0.139	1.379	1.622	0.003	0.1
36.	113.177	95.5	0.169	26.644 ± 0.151	15.064 ± 0.164	1.605	1.743	0.071	1.6
42.	90.371	76.3	0.141	26.762 ± 0.183	14.776 ± 0.188	1.737	1.790	0.109	2.1
48.	75.365	63.6	0.125	26.955 ± 0.216	14.642 ± 0.221	1.878	1.917	0.381	6.2
54.	62.305	52.6	0.110	27.116 ± 0.263	14.559 ± 0.255	2.072	2.009	0.840	11.1
60.	49.755	42.0	0.092	26.946 ± 0.292	14.382 ± 0.307	2.062	2.169	0.905	12.0
66.	38.645	32.6	0.076	26.898 ± 0.332	13.954 ± 0.341	2.064	2.122	1.149	15.1
72.	33.762	28.5	0.069	26.829 ± 0.357	13.644 ± 0.359	2.075	2.085	1.144	14.9
78.	30.082	25.4	0.064	26.652 ± 0.367	13.382 ± 0.347	2.012	1.901	0.803	11.2
84.	27.475	23.2	0.061	26.598 ± 0.375	13.376 ± 0.376	1.967	1.969	1.011	14.7
90.	24.651	20.8	0.058	26.446 ± 0.388	13.311 ± 0.369	1.926	1.932	1.200	17.9
96.	21.938	18.5	0.054	26.294 ± 0.417	13.289 ± 0.374	1.952	1.754	1.385	20.0

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7801 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	246.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	246.	100.0	25.795 ± 0.017	15.424 ± 0.017	0.269	0.269	-0.017	-12.9
6.	246.	100.0	25.838 ± 0.034	15.285 ± 0.033	0.529	0.516	-0.073	-14.6
9.	246.	100.0	25.913 ± 0.050	15.149 ± 0.047	0.783	0.738	-0.172	-15.7
12.	246.	100.0	26.009 ± 0.066	15.017 ± 0.060	1.032	0.937	-0.303	-15.9
18.	244.	99.2	26.203 ± 0.095	14.779 ± 0.081	1.489	1.262	-0.556	-14.1
24.	240.	97.6	26.341 ± 0.120	14.566 ± 0.098	1.864	1.518	-0.655	-10.7
30.	238.	96.7	26.442 ± 0.142	14.316 ± 0.114	2.186	1.762	-0.674	-8.0
36.	235.	95.5	26.459 ± 0.159	14.047 ± 0.130	2.443	1.992	-0.552	-5.3
42.	228.	92.7	26.398 ± 0.178	13.815 ± 0.146	2.694	2.208	-0.199	-1.6
48.	216.	87.8	26.152 ± 0.193	13.516 ± 0.154	2.833	2.256	-0.409	-2.9
54.	207.	84.1	25.966 ± 0.213	13.406 ± 0.155	3.071	2.235	-0.195	-1.2
60.	201.	81.7	25.785 ± 0.234	13.322 ± 0.160	3.320	2.273	-0.143	-0.7
66.	195.	79.3	25.513 ± 0.249	13.252 ± 0.161	3.480	2.248	-0.696	-3.3
72.	188.	76.4	25.150 ± 0.259	13.271 ± 0.160	3.557	2.190	-1.396	-6.3
78.	180.	73.2	24.799 ± 0.267	13.392 ± 0.161	3.578	2.155	-2.160	-9.6
84.	174.	70.7	24.582 ± 0.271	13.595 ± 0.169	3.577	2.235	-2.730	-12.0
90.	169.	68.7	24.489 ± 0.273	13.839 ± 0.185	3.550	2.401	-3.412	-15.1
96.	161.	65.4	24.524 ± 0.274	13.995 ± 0.196	3.479	2.489	-3.632	-16.7

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7801 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1013.320	100.0	4.119	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	872.924	86.1	3.548	25.797 ± 0.009	15.427 ± 0.009	0.267	0.266	-0.017	-13.2
6.	752.218	74.2	3.058	25.839 ± 0.019	15.301 ± 0.018	0.522	0.500	-0.072	-14.8
9.	650.007	64.1	2.642	25.903 ± 0.030	15.181 ± 0.028	0.772	0.706	-0.162	-15.2
12.	563.968	55.7	2.293	25.984 ± 0.043	15.062 ± 0.038	1.018	0.891	-0.278	-15.0
18.	423.155	41.8	1.734	26.148 ± 0.071	14.846 ± 0.058	1.468	1.197	-0.508	-13.3
24.	316.890	31.3	1.320	26.257 ± 0.103	14.652 ± 0.080	1.834	1.424	-0.607	-10.2
30.	240.470	23.7	1.010	26.345 ± 0.139	14.408 ± 0.106	2.155	1.646	-0.688	-8.4
36.	181.417	17.9	0.772	26.357 ± 0.179	14.136 ± 0.138	2.410	1.856	-0.693	-6.8
42.	134.335	13.3	0.589	26.287 ± 0.229	13.903 ± 0.177	2.652	2.049	-0.519	-4.2
48.	99.427	9.8	0.460	26.153 ± 0.285	13.679 ± 0.212	2.843	2.112	-0.476	-3.4
54.	73.656	7.3	0.356	26.030 ± 0.357	13.557 ± 0.245	3.065	2.102	-0.269	-1.6
60.	54.247	5.4	0.270	25.882 ± 0.448	13.452 ± 0.293	3.299	2.158	-0.256	-1.3
66.	39.291	3.9	0.201	25.646 ± 0.555	13.345 ± 0.340	3.478	2.131	-0.851	-4.0
72.	28.386	2.8	0.151	25.329 ± 0.573	13.327 ± 0.387	3.584	2.064	-1.424	-6.3
78.	20.466	2.0	0.114	24.952 ± 0.790	13.391 ± 0.443	3.575	2.004	-1.927	-8.6
84.	15.189	1.5	0.087	24.605 ± 0.919	13.556 ± 0.520	3.580	2.026	-2.331	-10.3
90.	11.312	1.1	0.067	24.785 ± 1.052	13.761 ± 0.638	3.537	2.145	-2.957	-13.3
96.	8.385	0.8	0.052	24.885 ± 1.195	13.992 ± 0.782	3.463	2.265	-3.324	-15.5

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7801 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	47.010	100.0	0.191	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	58.268	123.9	0.237	25.802 ± 0.034	15.439 ± 0.032	0.262	0.244	-0.016	-13.2
6.	68.205	145.1	0.277	25.826 ± 0.062	15.327 ± 0.053	0.514	0.438	-0.061	-13.0
9.	75.580	160.8	0.307	25.862 ± 0.087	15.217 ± 0.069	0.756	0.600	-0.118	-11.6
12.	80.598	171.5	0.328	25.926 ± 0.111	15.105 ± 0.084	0.996	0.758	-0.199	-11.4
18.	86.916	184.9	0.356	26.083 ± 0.157	14.898 ± 0.110	1.463	1.025	-0.392	-10.4
24.	89.353	190.1	0.372	26.191 ± 0.195	14.705 ± 0.130	1.845	1.230	-0.436	-7.1
30.	89.688	190.8	0.377	26.296 ± 0.230	14.435 ± 0.156	2.182	1.474	-0.519	-6.2
36.	86.623	184.3	0.369	26.315 ± 0.263	14.122 ± 0.182	2.446	1.696	-0.645	-6.2
42.	80.749	171.8	0.354	26.248 ± 0.299	13.872 ± 0.209	2.690	1.874	-0.664	-5.2
48.	75.788	161.2	0.351	26.177 ± 0.332	13.669 ± 0.221	2.890	1.925	-0.673	-4.6
54.	69.542	147.9	0.336	26.117 ± 0.374	13.556 ± 0.228	3.119	1.905	-0.584	-3.4
60.	60.022	127.7	0.299	26.045 ± 0.438	13.404 ± 0.251	3.391	1.941	-0.852	-4.2
66.	53.550	113.9	0.275	25.950 ± 0.490	13.269 ± 0.255	3.587	1.863	-1.506	-6.7
72.	47.779	101.6	0.254	25.873 ± 0.540	13.280 ± 0.258	3.731	1.785	-1.560	-6.4
78.	41.169	87.6	0.229	25.544 ± 0.578	13.379 ± 0.253	3.707	1.625	-1.662	-6.9
84.	37.196	79.1	0.214	25.583 ± 0.597	13.547 ± 0.256	3.643	1.560	-1.771	-7.6
90.	33.776	71.8	0.200	25.872 ± 0.608	13.726 ± 0.278	3.535	1.616	-2.089	-9.5
96.	31.258	66.5	0.194	26.097 ± 0.512	14.040 ± 0.312	3.424	1.745	-2.396	-11.5

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7807 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	248.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	248.	100.0	25.871 ± 0.007	15.558 ± 0.008	0.110	0.127	0.004	18.6
6.	248.	100.0	25.951 ± 0.014	15.559 ± 0.016	0.219	0.253	0.017	19.2
9.	248.	100.0	26.028 ± 0.021	15.562 ± 0.024	0.325	0.378	0.038	19.8
12.	248.	100.0	26.102 ± 0.027	15.567 ± 0.032	0.426	0.497	0.068	20.5
18.	248.	100.0	26.237 ± 0.039	15.585 ± 0.046	0.611	0.717	0.148	21.6
24.	248.	100.0	26.366 ± 0.049	15.610 ± 0.058	0.779	0.913	0.251	22.4
30.	248.	100.0	26.495 ± 0.059	15.644 ± 0.069	0.932	1.082	0.364	22.8
36.	248.	100.0	26.629 ± 0.068	15.685 ± 0.078	1.070	1.223	0.477	22.6
42.	248.	100.0	26.771 ± 0.076	15.735 ± 0.085	1.192	1.338	0.579	22.2
48.	248.	100.0	26.922 ± 0.082	15.796 ± 0.091	1.298	1.440	0.671	21.7
54.	248.	100.0	27.076 ± 0.088	15.868 ± 0.098	1.390	1.538	0.751	21.3
60.	248.	100.0	27.226 ± 0.093	15.950 ± 0.104	1.466	1.635	0.813	20.7
66.	248.	100.0	27.369 ± 0.097	16.042 ± 0.110	1.529	1.725	0.845	19.9
72.	241.	97.2	27.524 ± 0.103	16.025 ± 0.109	1.602	1.686	0.922	19.8
78.	238.	96.0	27.683 ± 0.107	16.081 ± 0.110	1.651	1.693	0.968	19.6
84.	237.	95.6	27.836 ± 0.109	16.188 ± 0.113	1.680	1.734	0.957	18.7
90.	236.	95.2	27.979 ± 0.110	16.314 ± 0.115	1.696	1.772	0.898	17.3
96.	233.	94.0	28.151 ± 0.108	16.428 ± 0.117	1.651	1.784	0.973	19.7

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7807 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	494.982	100.0	1.996	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	406.628	82.2	1.640	25.870 ± 0.005	15.558 ± 0.006	0.110	0.127	0.004	18.4
6.	335.727	67.8	1.354	25.946 ± 0.012	15.555 ± 0.014	0.218	0.254	0.016	18.4
9.	277.437	56.0	1.119	26.016 ± 0.019	15.550 ± 0.023	0.323	0.379	0.035	18.4
12.	229.914	46.4	0.927	26.082 ± 0.028	15.544 ± 0.033	0.424	0.500	0.060	18.6
18.	158.471	32.0	0.639	26.198 ± 0.049	15.528 ± 0.057	0.612	0.718	0.127	18.8
24.	108.926	22.0	0.439	26.291 ± 0.076	15.505 ± 0.087	0.790	0.904	0.201	17.8
30.	75.094	15.2	0.303	26.377 ± 0.110	15.481 ± 0.122	0.956	1.056	0.267	16.3
36.	51.967	10.5	0.210	26.477 ± 0.153	15.470 ± 0.162	1.105	1.171	0.338	15.5
42.	35.966	7.3	0.145	26.615 ± 0.206	15.473 ± 0.207	1.236	1.244	0.414	15.2
48.	24.615	5.0	0.099	26.792 ± 0.271	15.486 ± 0.259	1.343	1.287	0.502	15.5
54.	17.018	3.4	0.069	26.992 ± 0.344	15.507 ± 0.320	1.417	1.319	0.584	16.2
60.	11.955	2.4	0.048	27.179 ± 0.424	15.551 ± 0.395	1.466	1.366	0.630	16.3
66.	8.325	1.7	0.034	27.336 ± 0.522	15.604 ± 0.496	1.506	1.432	0.648	15.9
72.	5.668	1.1	0.024	27.496 ± 0.652	15.622 ± 0.618	1.552	1.470	0.684	15.8
78.	3.857	0.8	0.016	27.668 ± 0.813	15.668 ± 0.782	1.597	1.536	0.719	15.7
84.	2.588	0.5	0.011	27.857 ± 1.009	15.720 ± 0.994	1.624	1.599	0.791	16.7
90.	1.726	0.3	0.007	28.030 ± 1.232	15.782 ± 1.258	1.619	1.652	0.865	18.3
96.	1.127	0.2	0.005	28.174 ± 1.501	15.856 ± 1.597	1.593	1.695	0.926	20.1

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 7807 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	47.392	100.0	0.191	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	72.576	153.1	0.293	25.871 ± 0.013	15.558 ± 0.015	0.110	0.127	0.004	18.5
6.	91.977	194.1	0.371	25.945 ± 0.023	15.554 ± 0.026	0.218	0.252	0.015	17.7
9.	105.812	223.3	0.427	26.014 ± 0.031	15.542 ± 0.037	0.323	0.376	0.032	17.1
12.	114.232	241.0	0.461	26.079 ± 0.040	15.519 ± 0.047	0.423	0.498	0.058	17.8
18.	124.023	261.7	0.500	26.188 ± 0.056	15.470 ± 0.065	0.622	0.719	0.126	18.0
24.	119.587	252.3	0.482	26.222 ± 0.074	15.396 ± 0.083	0.806	0.903	0.156	13.5
30.	114.509	241.6	0.462	26.234 ± 0.090	15.339 ± 0.098	0.959	1.044	0.126	7.8
36.	101.974	215.2	0.411	26.279 ± 0.108	15.273 ± 0.113	1.094	1.137	0.152	7.2
42.	90.122	190.2	0.363	26.418 ± 0.127	15.244 ± 0.121	1.210	1.147	0.256	9.9
48.	72.842	153.7	0.294	26.668 ± 0.155	15.251 ± 0.129	1.324	1.105	0.525	16.7
54.	66.342	140.0	0.268	26.964 ± 0.174	15.368 ± 0.136	1.420	1.108	0.595	16.4
60.	59.077	124.7	0.238	27.169 ± 0.187	15.475 ± 0.145	1.438	1.114	0.480	13.1
66.	47.965	101.2	0.193	27.347 ± 0.207	15.529 ± 0.165	1.436	1.144	0.383	10.5
72.	38.748	81.8	0.161	27.623 ± 0.225	15.557 ± 0.190	1.402	1.181	0.493	14.1
78.	30.882	65.2	0.130	27.812 ± 0.262	15.626 ± 0.235	1.458	1.308	0.549	14.5
84.	22.468	47.4	0.095	28.092 ± 0.305	15.502 ± 0.283	1.445	1.339	1.094	27.7
90.	15.715	33.2	0.067	28.350 ± 0.359	15.517 ± 0.377	1.422	1.496	1.141	29.4
96.	10.183	21.5	0.044	28.532 ± 0.465	15.631 ± 0.431	1.483	1.376	0.884	21.9

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1978 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2872.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	2872.	100.0	23.424 ± 0.004	13.116 ± 0.005	0.204	0.242	0.003	4.3
6.	2872.	100.0	23.438 ± 0.008	13.129 ± 0.009	0.406	0.468	0.013	4.6
9.	2872.	100.0	23.449 ± 0.011	13.149 ± 0.013	0.595	0.673	0.035	5.6
12.	2872.	100.0	23.456 ± 0.015	13.175 ± 0.016	0.778	0.865	0.070	6.5
18.	2872.	100.0	23.466 ± 0.021	13.243 ± 0.022	1.119	1.201	0.183	8.3
24.	2862.	99.7	23.478 ± 0.027	13.350 ± 0.027	1.429	1.465	0.317	8.8
30.	2842.	99.0	23.501 ± 0.032	13.498 ± 0.031	1.707	1.661	0.413	8.1
36.	2824.	98.3	23.528 ± 0.037	13.658 ± 0.035	1.945	1.835	0.455	6.9
42.	2792.	97.2	23.575 ± 0.041	13.827 ± 0.037	2.145	1.967	0.439	5.5
48.	2742.	95.5	23.665 ± 0.044	13.968 ± 0.039	2.297	2.062	0.436	4.7
54.	2692.	93.7	23.731 ± 0.047	14.096 ± 0.040	2.442	2.099	0.373	3.6
60.	2651.	92.3	23.781 ± 0.050	14.227 ± 0.042	2.579	2.146	0.202	1.7
66.	2588.	90.1	23.860 ± 0.052	14.333 ± 0.043	2.666	2.197	-0.063	-0.5
72.	2522.	87.8	23.917 ± 0.054	14.444 ± 0.045	2.729	2.243	-0.406	-3.1
78.	2437.	84.9	23.995 ± 0.056	14.553 ± 0.046	2.747	2.265	-0.531	-4.0
84.	2341.	81.5	24.101 ± 0.057	14.603 ± 0.047	2.741	2.258	-0.585	-4.5
90.	2272.	79.1	24.199 ± 0.058	14.676 ± 0.048	2.754	2.291	-0.701	-5.3
96.	2189.	76.2	24.285 ± 0.059	14.725 ± 0.049	2.740	2.297	-0.749	-5.7

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1978 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	7978.269	100.0	2.778	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	6869.870	86.1	2.392	23.425 ± 0.003	13.093 ± 0.003	0.208	0.252	0.004	4.7
6.	5935.467	74.4	2.067	23.440 ± 0.005	13.082 ± 0.006	0.409	0.487	0.017	5.7
9.	5141.664	64.4	1.790	23.452 ± 0.008	13.076 ± 0.010	0.600	0.700	0.045	7.1
12.	4463.060	55.9	1.554	23.460 ± 0.012	13.076 ± 0.013	0.788	0.896	0.091	8.4
18.	3378.062	42.3	1.176	23.464 ± 0.020	13.092 ± 0.021	1.139	1.231	0.236	10.3
24.	2536.676	31.8	0.886	23.472 ± 0.029	13.157 ± 0.030	1.459	1.488	0.398	10.6
30.	1902.048	23.8	0.669	23.491 ± 0.040	13.282 ± 0.039	1.743	1.684	0.491	9.2
36.	1431.813	17.9	0.507	23.508 ± 0.052	13.426 ± 0.049	1.984	1.869	0.472	6.8
42.	1070.442	13.4	0.383	23.539 ± 0.067	13.582 ± 0.061	2.184	2.002	0.354	4.2
48.	797.969	10.0	0.291	23.606 ± 0.083	13.703 ± 0.073	2.342	2.070	0.244	2.5
54.	595.654	7.5	0.221	23.656 ± 0.102	13.811 ± 0.085	2.492	2.063	0.145	1.3
60.	447.195	5.6	0.169	23.685 ± 0.123	13.946 ± 0.099	2.610	2.097	-0.077	-0.6
66.	334.551	4.2	0.129	23.753 ± 0.148	14.056 ± 0.117	2.714	2.148	-0.411	-3.2
72.	248.813	3.1	0.099	23.801 ± 0.176	14.155 ± 0.140	2.783	2.201	-0.859	-6.3
78.	182.024	2.3	0.075	23.892 ± 0.206	14.230 ± 0.164	2.774	2.212	-0.994	-7.4
84.	133.417	1.7	0.057	24.003 ± 0.238	14.250 ± 0.191	2.753	2.202	-1.120	-8.4
90.	99.740	1.3	0.044	24.106 ± 0.275	14.304 ± 0.226	2.746	2.255	-1.272	-9.6
96.	74.393	0.9	0.034	24.224 ± 0.314	14.310 ± 0.262	2.706	2.261	-1.164	-9.0

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1978 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	502.424	100.0	0.175	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	730.649	145.4	0.254	23.436 ± 0.007	13.117 ± 0.008	0.191	0.228	0.006	9.0
6.	929.650	185.0	0.324	23.464 ± 0.012	13.132 ± 0.014	0.373	0.432	0.025	10.3
9.	1084.811	215.9	0.378	23.490 ± 0.017	13.148 ± 0.019	0.548	0.619	0.059	11.2
12.	1200.183	238.9	0.418	23.517 ± 0.021	13.162 ± 0.023	0.719	0.789	0.112	12.2
18.	1342.003	267.1	0.467	23.564 ± 0.028	13.200 ± 0.029	1.040	1.080	0.260	13.5
24.	1363.113	271.3	0.476	23.634 ± 0.036	13.257 ± 0.036	1.323	1.314	0.428	13.7
30.	1333.454	265.4	0.469	23.713 ± 0.043	13.353 ± 0.041	1.583	1.501	0.515	11.6
36.	1252.263	249.2	0.443	23.757 ± 0.051	13.436 ± 0.047	1.806	1.650	0.501	8.7
42.	1147.154	228.3	0.411	23.804 ± 0.059	13.532 ± 0.052	1.998	1.769	0.399	5.7
48.	1049.253	208.8	0.383	23.883 ± 0.067	13.641 ± 0.057	2.169	1.860	0.296	3.6
54.	938.175	186.7	0.349	23.951 ± 0.075	13.711 ± 0.062	2.307	1.892	0.293	3.1
60.	835.472	166.3	0.315	24.013 ± 0.083	13.800 ± 0.066	2.396	1.911	0.082	0.8
66.	736.331	146.6	0.285	24.131 ± 0.092	13.850 ± 0.071	2.494	1.937	-0.190	-1.7
72.	642.776	127.9	0.255	24.246 ± 0.101	13.890 ± 0.077	2.551	1.963	-0.494	-4.3
78.	555.215	110.5	0.228	24.380 ± 0.109	13.902 ± 0.083	2.544	1.964	-0.531	-4.7
84.	481.054	95.7	0.205	24.510 ± 0.116	13.893 ± 0.090	2.545	1.974	-0.600	-5.3
90.	426.830	85.0	0.188	24.645 ± 0.123	13.901 ± 0.097	2.533	2.009	-0.646	-5.8
96.	375.107	74.7	0.171	24.777 ± 0.128	13.900 ± 0.105	2.476	2.034	-0.441	-4.1

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1979 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2886.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	2886.	100.0	23.446 ± 0.004	13.127 ± 0.005	0.198	0.253	0.012	17.0
6.	2886.	100.0	23.474 ± 0.007	13.158 ± 0.009	0.401	0.495	0.046	15.9
9.	2886.	100.0	23.493 ± 0.011	13.201 ± 0.013	0.604	0.720	0.100	15.3
12.	2884.	99.9	23.507 ± 0.015	13.254 ± 0.017	0.798	0.921	0.170	15.0
18.	2818.	97.6	23.556 ± 0.021	13.440 ± 0.022	1.112	1.172	0.276	12.6
24.	2767.	95.9	23.604 ± 0.026	13.630 ± 0.026	1.386	1.368	0.444	13.0
30.	2712.	94.0	23.673 ± 0.031	13.814 ± 0.030	1.614	1.540	0.552	12.0
36.	2659.	92.1	23.733 ± 0.035	13.985 ± 0.033	1.799	1.678	0.577	10.1
42.	2610.	90.4	23.798 ± 0.038	14.141 ± 0.035	1.949	1.799	0.504	7.5
48.	2547.	88.3	23.831 ± 0.041	14.298 ± 0.037	2.046	1.891	0.365	5.0
54.	2466.	85.4	23.860 ± 0.043	14.460 ± 0.039	2.117	1.955	0.235	3.0
60.	2399.	83.1	23.875 ± 0.045	14.597 ± 0.041	2.190	2.020	0.081	1.0
66.	2317.	80.3	23.901 ± 0.046	14.684 ± 0.043	2.227	2.059	0.179	2.1
72.	2243.	77.7	23.911 ± 0.048	14.775 ± 0.045	2.263	2.125	0.138	1.5
78.	2147.	74.4	23.946 ± 0.050	14.850 ± 0.046	2.296	2.151	0.085	0.9
84.	2054.	71.2	23.965 ± 0.051	14.931 ± 0.048	2.329	2.177	0.165	1.7
90.	1970.	68.3	23.976 ± 0.053	14.982 ± 0.049	2.366	2.183	0.167	1.7
96.	1892.	65.6	23.967 ± 0.055	15.002 ± 0.050	2.401	2.192	0.118	1.2

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1979 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8024.939	100.0	2.781	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	6948.988	86.6	2.408	23.443 ± 0.002	13.110 ± 0.003	0.208	0.269	0.014	18.1
6.	6035.686	75.2	2.091	23.469 ± 0.005	13.124 ± 0.007	0.421	0.520	0.055	17.1
9.	5249.522	65.4	1.819	23.487 ± 0.009	13.151 ± 0.010	0.635	0.751	0.121	16.7
12.	4563.720	56.9	1.582	23.502 ± 0.012	13.189 ± 0.014	0.836	0.956	0.207	16.5
18.	3357.863	41.8	1.192	23.561 ± 0.020	13.368 ± 0.021	1.144	1.195	0.332	14.2
24.	2492.989	31.1	0.901	23.613 ± 0.028	13.558 ± 0.028	1.404	1.384	0.504	14.4
30.	1860.543	23.2	0.686	23.668 ± 0.038	13.730 ± 0.036	1.618	1.570	0.609	13.1
36.	1388.013	17.3	0.522	23.704 ± 0.048	13.891 ± 0.046	1.795	1.722	0.624	11.0
42.	1039.251	13.0	0.398	23.726 ± 0.060	14.043 ± 0.058	1.940	1.859	0.541	8.2
48.	770.679	9.6	0.303	23.715 ± 0.073	14.203 ± 0.071	2.026	1.958	0.344	4.8
54.	568.427	7.1	0.231	23.698 ± 0.088	14.367 ± 0.085	2.104	2.034	0.204	2.6
60.	421.634	5.3	0.176	23.675 ± 0.106	14.512 ± 0.103	2.176	2.120	0.016	0.2
66.	308.300	3.8	0.133	23.682 ± 0.125	14.608 ± 0.124	2.200	2.169	0.171	2.0
72.	227.701	2.8	0.102	23.647 ± 0.146	14.673 ± 0.149	2.206	2.253	0.127	1.5
78.	166.439	2.1	0.078	23.607 ± 0.169	14.721 ± 0.178	2.185	2.301	0.019	0.2
84.	121.429	1.5	0.059	23.586 ± 0.201	14.786 ± 0.211	2.211	2.125	0.086	1.0
90.	88.832	1.1	0.045	23.561 ± 0.237	14.806 ± 0.246	2.237	2.315	-0.009	-0.1
96.	65.624	0.8	0.035	23.550 ± 0.279	14.801 ± 0.287	2.263	2.321	-0.197	-2.2

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1979 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	504.876	100.0	0.175	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	744.703	147.5	0.258	23.449 ± 0.007	13.128 ± 0.009	0.191	0.236	0.011	16.9
6.	949.657	188.1	0.329	23.483 ± 0.012	13.166 ± 0.015	0.380	0.451	0.041	15.9
9.	1107.279	219.3	0.384	23.513 ± 0.017	13.211 ± 0.020	0.567	0.652	0.091	15.7
12.	1220.867	241.8	0.423	23.540 ± 0.021	13.253 ± 0.024	0.747	0.833	0.156	15.6
18.	1338.171	265.0	0.475	23.607 ± 0.028	13.370 ± 0.029	1.019	1.078	0.271	14.6
24.	1359.124	269.2	0.491	23.668 ± 0.034	13.498 ± 0.035	1.240	1.273	0.403	14.7
30.	1311.181	259.7	0.483	23.711 ± 0.040	13.602 ± 0.040	1.432	1.448	0.491	13.5
36.	1220.999	241.8	0.459	23.748 ± 0.046	13.674 ± 0.045	1.599	1.571	0.505	11.2
42.	1132.056	224.2	0.434	23.780 ± 0.052	13.753 ± 0.051	1.748	1.707	0.487	9.0
48.	1005.878	199.2	0.395	23.762 ± 0.057	13.845 ± 0.057	1.813	1.798	0.379	6.6
54.	890.421	176.4	0.361	23.760 ± 0.063	13.959 ± 0.062	1.867	1.854	0.301	4.9
60.	780.594	154.6	0.325	23.754 ± 0.069	14.063 ± 0.070	1.922	1.954	0.162	2.5
66.	668.696	132.4	0.289	23.770 ± 0.076	14.142 ± 0.078	1.973	2.021	0.240	3.5
72.	580.631	115.0	0.259	23.784 ± 0.083	14.147 ± 0.086	1.991	2.073	0.226	3.3
78.	491.487	97.3	0.229	23.775 ± 0.088	14.183 ± 0.097	1.957	2.145	-0.058	-0.9
84.	409.210	81.1	0.199	23.758 ± 0.098	14.293 ± 0.110	1.975	2.230	-0.143	-2.1
90.	343.017	67.9	0.174	23.770 ± 0.110	14.333 ± 0.120	2.039	2.217	-0.266	-3.7
96.	292.067	57.8	0.154	23.762 ± 0.122	14.302 ± 0.130	2.078	2.230	-0.398	-5.3

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1980 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2894.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	2894.	100.0	23.432 ± 0.004	13.136 ± 0.004	0.210	0.222	0.012	15.0
6.	2894.	100.0	23.444 ± 0.008	13.174 ± 0.008	0.426	0.431	0.048	14.8
9.	2894.	100.0	23.449 ± 0.012	13.223 ± 0.012	0.643	0.626	0.104	14.1
12.	2894.	100.0	23.450 ± 0.016	13.281 ± 0.015	0.847	0.808	0.169	13.2
18.	2874.	99.3	23.465 ± 0.022	13.420 ± 0.021	1.183	1.117	0.234	9.5
24.	2827.	97.7	23.504 ± 0.027	13.600 ± 0.025	1.443	1.356	0.190	5.2
30.	2757.	95.3	23.559 ± 0.031	13.803 ± 0.030	1.629	1.553	0.099	2.1
36.	2689.	92.9	23.611 ± 0.034	13.977 ± 0.033	1.785	1.702	0.044	0.8
42.	2616.	90.4	23.675 ± 0.037	14.117 ± 0.036	1.900	1.828	-0.006	-0.1
48.	2541.	87.8	23.748 ± 0.040	14.247 ± 0.038	2.013	1.923	-0.087	-1.2
54.	2459.	85.0	23.778 ± 0.042	14.349 ± 0.041	2.091	2.012	-0.139	-1.8
60.	2373.	82.0	23.777 ± 0.044	14.414 ± 0.043	2.144	2.073	-0.134	-1.7
66.	2286.	79.0	23.809 ± 0.046	14.509 ± 0.044	2.212	2.106	0.005	0.1
72.	2201.	76.1	23.835 ± 0.048	14.587 ± 0.046	2.268	2.141	0.094	1.0
78.	2116.	73.1	23.841 ± 0.050	14.688 ± 0.047	2.321	2.148	0.212	2.2
84.	2033.	70.2	23.844 ± 0.052	14.824 ± 0.048	2.353	2.175	0.143	1.5
90.	1948.	67.3	23.888 ± 0.054	14.945 ± 0.050	2.373	2.187	0.157	1.6
96.	1866.	64.5	23.942 ± 0.056	15.026 ± 0.051	2.398	2.184	0.185	1.8

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1980 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8057.893	100.0	2.784	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	7033.979	87.3	2.431	23.427 ± 0.003	13.123 ± 0.003	0.217	0.229	0.014	16.8
6.	6145.295	76.3	2.123	23.433 ± 0.006	13.149 ± 0.006	0.442	0.442	0.057	16.3
9.	5362.606	66.6	1.853	23.431 ± 0.009	13.187 ± 0.009	0.666	0.637	0.120	15.2
12.	4676.005	58.0	1.616	23.427 ± 0.013	13.234 ± 0.012	0.877	0.820	0.187	13.6
18.	3529.789	43.8	1.228	23.441 ± 0.021	13.363 ± 0.019	1.224	1.122	0.220	8.3
24.	2650.138	32.9	0.937	23.482 ± 0.029	13.528 ± 0.027	1.498	1.376	0.141	3.6
30.	1969.544	24.4	0.714	23.531 ± 0.038	13.719 ± 0.036	1.701	1.611	0.033	0.6
36.	1453.072	18.0	0.540	23.586 ± 0.049	13.883 ± 0.047	1.859	1.785	-0.075	-1.2
42.	1048.422	13.3	0.408	23.653 ± 0.060	14.001 ± 0.059	1.971	1.931	-0.200	-2.9
48.	786.196	9.8	0.309	23.708 ± 0.075	14.109 ± 0.072	2.092	2.032	-0.343	-4.5
54.	578.572	7.2	0.235	23.697 ± 0.090	14.183 ± 0.089	2.167	2.145	-0.481	-5.9
60.	423.018	5.2	0.178	23.587 ± 0.108	14.241 ± 0.109	2.220	2.252	-0.444	-5.1
66.	307.720	3.8	0.135	23.698 ± 0.130	14.302 ± 0.133	2.272	2.330	-0.126	-1.4
72.	222.428	2.8	0.101	23.669 ± 0.154	14.338 ± 0.160	2.294	2.392	-0.012	-0.1
78.	160.483	2.0	0.076	23.631 ± 0.183	14.365 ± 0.189	2.315	2.397	-0.015	-0.2
84.	115.022	1.4	0.057	23.567 ± 0.214	14.427 ± 0.225	2.291	2.417	-0.201	-2.2
90.	82.687	1.0	0.042	23.534 ± 0.251	14.477 ± 0.264	2.285	2.402	-0.233	-2.6
96.	59.930	0.7	0.032	23.522 ± 0.295	14.527 ± 0.309	2.284	2.388	-0.186	-2.0

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 1980 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	506.405	100.0	0.175	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	769.849	152.0	0.266	23.439 ± 0.007	13.138 ± 0.008	0.199	0.210	0.012	16.6
6.	991.590	195.8	0.343	23.462 ± 0.012	13.179 ± 0.013	0.393	0.401	0.043	15.6
9.	1158.226	228.7	0.400	23.479 ± 0.017	13.226 ± 0.017	0.588	0.577	0.087	14.2
12.	1277.675	252.3	0.441	23.492 ± 0.022	13.272 ± 0.021	0.773	0.740	0.131	12.4
18.	1408.560	278.1	0.490	23.540 ± 0.029	13.366 ± 0.027	1.081	1.005	0.149	7.3
24.	1419.347	280.3	0.502	23.596 ± 0.035	13.452 ± 0.033	1.333	1.246	0.118	3.8
30.	1356.648	267.9	0.492	23.640 ± 0.041	13.538 ± 0.040	1.508	1.470	0.058	1.5
36.	1238.096	244.5	0.460	23.690 ± 0.047	13.601 ± 0.046	1.642	1.631	-0.010	-0.2
42.	1116.255	220.4	0.427	23.758 ± 0.053	13.645 ± 0.052	1.762	1.754	-0.049	-0.9
48.	1001.357	197.7	0.394	23.831 ± 0.060	13.726 ± 0.059	1.897	1.873	-0.121	-1.9
54.	894.246	176.6	0.364	23.850 ± 0.066	13.779 ± 0.067	1.971	2.007	-0.177	-2.6
60.	777.524	153.5	0.328	23.850 ± 0.073	13.808 ± 0.077	2.038	2.142	-0.123	-1.7
66.	662.853	130.9	0.290	23.803 ± 0.080	13.825 ± 0.088	2.068	2.270	0.043	0.6
72.	553.319	109.3	0.251	23.687 ± 0.087	13.785 ± 0.100	2.041	2.343	-0.053	-0.7
78.	461.735	91.2	0.218	23.669 ± 0.098	13.759 ± 0.109	2.100	2.349	-0.146	-1.9
84.	382.637	75.6	0.188	23.640 ± 0.106	13.769 ± 0.119	2.079	2.327	-0.310	-4.1
90.	317.649	62.7	0.163	23.595 ± 0.115	13.807 ± 0.128	2.046	2.286	-0.217	-3.0
96.	269.581	53.2	0.144	23.617 ± 0.125	13.834 ± 0.137	2.053	2.257	-0.032	-0.4

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: JAN HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	738.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	738.	100.0	23.402 ± 0.009	12.975 ± 0.012	0.239	0.336	0.010	9.6
6.	738.	100.0	23.383 ± 0.019	12.858 ± 0.024	0.480	0.669	0.039	9.6
9.	738.	100.0	23.345 ± 0.026	12.759 ± 0.035	0.716	0.941	0.099	11.0
12.	736.	99.7	23.292 ± 0.034	12.687 ± 0.045	0.932	1.208	0.186	12.1
18.	687.	93.1	23.163 ± 0.049	12.749 ± 0.059	1.287	1.554	0.265	9.1
24.	652.	88.3	23.015 ± 0.062	12.900 ± 0.070	1.576	1.795	0.223	5.1
30.	634.	85.9	22.889 ± 0.072	13.107 ± 0.080	1.815	2.019	0.175	3.0
36.	611.	82.8	22.805 ± 0.081	13.347 ± 0.088	2.014	2.163	0.042	0.6
42.	586.	79.4	22.752 ± 0.089	13.582 ± 0.092	2.159	2.236	-0.048	-0.6
48.	570.	77.2	22.681 ± 0.097	13.828 ± 0.096	2.305	2.293	-0.303	-3.3
54.	552.	74.8	22.610 ± 0.103	14.078 ± 0.098	2.425	2.307	-0.528	-5.1
60.	528.	71.5	22.516 ± 0.109	14.319 ± 0.101	2.494	2.319	-0.569	-5.2
66.	493.	66.8	22.538 ± 0.116	14.468 ± 0.105	2.566	2.325	-0.432	-3.8
72.	458.	62.1	22.550 ± 0.123	14.578 ± 0.108	2.624	2.309	-0.903	-7.5
78.	420.	56.9	22.514 ± 0.128	14.775 ± 0.106	2.631	2.171	-0.691	-5.7
84.	403.	54.6	22.537 ± 0.134	15.017 ± 0.107	2.689	2.144	-0.736	-5.8
90.	383.	51.9	22.570 ± 0.136	15.270 ± 0.111	2.670	2.170	-0.713	-5.7
96.	370.	50.1	22.643 ± 0.143	15.531 ± 0.113	2.745	2.182	-0.816	-6.2

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: JAN HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	3039.960	100.0	4.119	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	2634.469	86.7	3.570	23.404 ± 0.005	12.975 ± 0.007	0.238	0.334	0.010	9.7
6.	2280.954	75.0	3.091	23.387 ± 0.010	12.856 ± 0.013	0.476	0.642	0.039	9.7
9.	1974.881	65.0	2.676	23.353 ± 0.016	12.753 ± 0.021	0.709	0.925	0.095	10.8
12.	1703.884	56.0	2.315	23.301 ± 0.022	12.672 ± 0.029	0.920	1.182	0.169	11.3
18.	1198.370	39.4	1.744	23.179 ± 0.037	12.711 ± 0.044	1.280	1.522	0.236	8.2
24.	856.420	28.2	1.314	23.052 ± 0.054	12.855 ± 0.061	1.588	1.776	0.203	4.6
30.	626.992	20.6	0.989	22.955 ± 0.074	13.071 ± 0.080	1.848	2.012	0.107	1.8
36.	455.505	15.0	0.746	22.894 ± 0.097	13.324 ± 0.102	2.063	2.183	-0.050	-0.7
42.	329.944	10.9	0.563	22.878 ± 0.122	13.577 ± 0.126	2.212	2.283	-0.167	-2.0
48.	243.135	8.0	0.427	22.805 ± 0.152	13.880 ± 0.150	2.369	2.339	-0.391	-4.0
54.	179.251	5.9	0.325	22.734 ± 0.186	14.190 ± 0.174	2.495	2.333	-0.565	-5.2
60.	130.423	4.3	0.247	22.673 ± 0.225	14.472 ± 0.203	2.568	2.321	-0.536	-4.6
66.	91.953	3.0	0.187	22.746 ± 0.275	14.635 ± 0.240	2.633	2.304	-0.236	-1.9
72.	64.212	2.1	0.140	22.790 ± 0.335	14.703 ± 0.279	2.682	2.233	-0.520	-4.1
78.	43.861	1.4	0.104	22.815 ± 0.407	14.816 ± 0.308	2.696	2.041	-0.059	-0.5
84.	31.937	1.1	0.079	22.861 ± 0.488	15.036 ± 0.355	2.756	2.005	-0.118	-0.9
90.	23.390	0.8	0.061	22.891 ± 0.569	15.284 ± 0.426	2.747	2.058	-0.222	-1.7
96.	17.244	0.6	0.047	22.965 ± 0.568	15.512 ± 0.510	2.775	2.119	-0.423	-3.1

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: JAN HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	141.029	100.0	0.191	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	180.966	128.3	0.245	23.411 ± 0.017	12.975 ± 0.024	0.234	0.327	0.010	10.0
6.	213.593	151.5	0.289	23.401 ± 0.032	12.853 ± 0.042	0.465	0.621	0.038	9.9
9.	237.810	168.6	0.322	23.369 ± 0.045	12.736 ± 0.057	0.689	0.886	0.090	10.7
12.	253.019	179.4	0.344	23.317 ± 0.056	12.625 ± 0.071	0.897	1.131	0.150	10.6
18.	255.690	181.3	0.372	23.215 ± 0.079	12.553 ± 0.091	1.260	1.457	0.197	7.1
24.	242.756	172.1	0.372	23.137 ± 0.102	12.614 ± 0.110	1.593	1.718	0.158	3.6
30.	227.559	161.4	0.359	23.104 ± 0.125	12.781 ± 0.131	1.891	1.979	-0.036	-0.6
36.	205.720	145.9	0.337	23.076 ± 0.150	13.029 ± 0.153	2.157	2.199	-0.251	-3.1
42.	184.814	131.0	0.315	23.099 ± 0.173	13.330 ± 0.173	2.348	2.347	-0.486	-5.0
48.	165.915	117.6	0.291	23.061 ± 0.198	13.766 ± 0.187	2.549	2.412	-0.793	-7.0
54.	151.048	107.1	0.274	22.997 ± 0.220	14.183 ± 0.195	2.703	2.398	-0.894	-7.0
60.	131.217	93.0	0.249	23.014 ± 0.249	14.612 ± 0.207	2.857	2.371	-0.724	-5.1
66.	108.053	76.6	0.219	23.176 ± 0.287	14.941 ± 0.227	2.982	2.365	-0.153	-1.0
72.	86.780	61.5	0.189	23.259 ± 0.331	14.988 ± 0.242	3.081	2.252	0.000	0.0
78.	67.460	47.8	0.161	23.319 ± 0.380	15.041 ± 0.244	3.119	2.003	0.741	4.4
84.	59.763	42.4	0.148	23.360 ± 0.412	15.196 ± 0.255	3.187	1.969	0.604	3.4
90.	53.465	37.9	0.140	23.354 ± 0.433	15.365 ± 0.291	3.164	2.058	0.407	2.3
96.	46.424	32.9	0.125	23.376 ± 0.453	15.556 ± 0.301	3.085	2.054	0.184	1.1

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: APR HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	720.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	720.	100.0	23.414 ± 0.008	13.149 ± 0.011	0.215	0.298	-0.011	-12.8
6.	720.	100.0	23.412 ± 0.016	13.204 ± 0.022	0.425	0.580	-0.045	-13.9
9.	720.	100.0	23.403 ± 0.023	13.268 ± 0.031	0.625	0.838	-0.101	-14.6
12.	720.	100.0	23.386 ± 0.030	13.336 ± 0.040	0.818	1.078	-0.179	-15.0
18.	720.	100.0	23.337 ± 0.043	13.460 ± 0.056	1.167	1.490	-0.361	-14.8
24.	712.	98.9	23.271 ± 0.054	13.601 ± 0.068	1.443	1.801	-0.484	-13.1
30.	691.	96.0	23.211 ± 0.061	13.788 ± 0.078	1.614	2.041	-0.592	-12.8
36.	669.	92.9	23.130 ± 0.065	13.946 ± 0.087	1.689	2.247	-0.783	-15.3
42.	652.	90.6	23.073 ± 0.071	14.097 ± 0.094	1.816	2.412	-1.021	-17.2
48.	627.	87.1	23.023 ± 0.076	14.312 ± 0.101	1.903	2.523	-1.334	-20.2
54.	602.	83.6	23.026 ± 0.083	14.486 ± 0.105	2.026	2.585	-1.708	-22.6
60.	581.	80.7	22.992 ± 0.090	14.672 ± 0.109	2.157	2.638	-2.105	-24.3
66.	562.	78.1	22.951 ± 0.097	14.876 ± 0.114	2.296	2.698	-2.420	-24.7
72.	542.	75.3	22.957 ± 0.103	15.078 ± 0.119	2.402	2.768	-2.746	-25.4
78.	507.	70.4	22.967 ± 0.108	15.201 ± 0.123	2.437	2.775	-2.794	-25.2
84.	470.	65.3	23.010 ± 0.113	15.227 ± 0.129	2.450	2.798	-2.832	-25.2
90.	441.	61.3	23.069 ± 0.121	15.243 ± 0.132	2.534	2.774	-3.113	-25.9
96.	404.	56.1	22.910 ± 0.120	15.334 ± 0.135	2.422	2.715	-2.825	-25.7

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: APR HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1834.524	100.0	2.548	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	1574.611	85.8	2.187	23.414 ± 0.005	13.144 ± 0.007	0.214	0.293	-0.010	-11.8
6.	1355.843	73.9	1.883	23.415 ± 0.011	13.186 ± 0.015	0.422	0.562	-0.038	-11.9
9.	1169.353	63.7	1.624	23.408 ± 0.018	13.231 ± 0.023	0.617	0.803	-0.082	-12.1
12.	1013.403	55.2	1.408	23.397 ± 0.025	13.272 ± 0.032	0.805	1.026	-0.141	-12.2
18.	766.173	41.8	1.064	23.375 ± 0.041	13.330 ± 0.051	1.144	1.411	-0.280	-12.1
24.	576.063	31.4	0.809	23.331 ± 0.059	13.417 ± 0.072	1.407	1.720	-0.364	-10.4
30.	428.455	23.4	0.620	23.269 ± 0.076	13.558 ± 0.096	1.570	1.989	-0.431	-9.9
36.	315.980	17.2	0.472	23.192 ± 0.091	13.690 ± 0.125	1.615	2.220	-0.686	-14.7
42.	237.086	12.9	0.364	23.157 ± 0.114	13.791 ± 0.157	1.751	2.421	-0.949	-17.2
48.	174.951	9.5	0.279	23.101 ± 0.138	13.973 ± 0.195	1.823	2.573	-1.237	-20.4
54.	129.262	7.0	0.215	23.075 ± 0.170	14.088 ± 0.232	1.930	2.640	-1.579	-23.0
60.	95.430	5.2	0.164	23.023 ± 0.212	14.230 ± 0.276	2.069	2.698	-2.072	-25.9
66.	69.795	3.8	0.124	22.906 ± 0.262	14.448 ± 0.332	2.191	2.774	-2.254	-25.1
72.	51.442	2.8	0.095	22.900 ± 0.327	14.587 ± 0.402	2.343	2.892	-2.710	-26.3
78.	36.020	2.0	0.071	22.834 ± 0.379	14.627 ± 0.478	2.275	2.869	-2.735	-27.9
84.	25.423	1.4	0.054	22.946 ± 0.466	14.518 ± 0.566	2.348	2.854	-2.866	-27.5
90.	18.392	1.0	0.042	23.053 ± 0.565	14.416 ± 0.651	2.424	2.790	-3.148	-28.2
96.	12.816	0.7	0.032	22.875 ± 0.511	14.469 ± 0.758	2.186	2.713	-2.645	-29.0

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: APR HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	114.658	100.0	0.159	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	153.179	133.6	0.213	23.415 ± 0.017	13.137 ± 0.022	0.211	0.278	-0.007	-9.1
6.	188.056	164.0	0.261	23.418 ± 0.030	13.172 ± 0.038	0.415	0.528	-0.026	-8.7
9.	215.430	187.9	0.299	23.420 ± 0.041	13.198 ± 0.052	0.605	0.760	-0.064	-9.9
12.	235.748	205.6	0.327	23.425 ± 0.051	13.204 ± 0.063	0.791	0.970	-0.117	-10.6
18.	256.804	224.0	0.357	23.444 ± 0.070	13.181 ± 0.083	1.122	1.327	-0.261	-11.7
24.	258.855	225.8	0.364	23.431 ± 0.084	13.198 ± 0.102	1.347	1.641	-0.334	-10.4
30.	246.723	215.2	0.357	23.419 ± 0.096	13.258 ± 0.121	1.506	1.936	-0.405	-10.1
36.	224.544	195.8	0.336	23.402 ± 0.104	13.255 ± 0.142	1.559	2.132	-0.666	-15.3
42.	207.245	180.8	0.318	23.467 ± 0.120	13.217 ± 0.162	1.733	2.337	-0.808	-15.1
48.	181.449	158.3	0.289	23.443 ± 0.135	13.234 ± 0.184	1.815	2.478	-1.123	-18.8
54.	160.521	140.0	0.267	23.404 ± 0.148	13.181 ± 0.193	1.877	2.443	-1.464	-22.6
60.	142.408	124.2	0.245	23.374 ± 0.169	13.291 ± 0.209	2.011	2.492	-2.011	-26.4
66.	119.208	104.0	0.212	23.298 ± 0.195	13.437 ± 0.233	2.141	2.545	-2.095	-24.6
72.	99.256	86.6	0.183	23.342 ± 0.225	13.250 ± 0.251	2.242	2.505	-2.330	-24.9
78.	80.252	70.0	0.158	23.432 ± 0.245	13.060 ± 0.263	2.195	2.353	-2.292	-25.4
84.	68.956	60.1	0.147	23.656 ± 0.275	12.856 ± 0.263	2.281	2.184	-2.341	-24.2
90.	62.482	54.5	0.142	23.797 ± 0.288	12.846 ± 0.277	2.280	2.188	-2.484	-25.5
96.	50.788	44.3	0.126	23.587 ± 0.249	12.867 ± 0.302	1.778	2.149	-1.689	-28.1

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: JJL HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	744.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	744.	100.0	23.436 ± 0.005	13.180 ± 0.004	0.131	0.106	0.002	7.4
6.	744.	100.0	23.463 ± 0.010	13.253 ± 0.008	0.260	0.211	0.008	7.1
9.	744.	100.0	23.491 ± 0.014	13.329 ± 0.012	0.386	0.315	0.018	6.9
12.	744.	100.0	23.522 ± 0.019	13.405 ± 0.015	0.507	0.414	0.030	6.7
18.	744.	100.0	23.588 ± 0.027	13.551 ± 0.022	0.730	0.594	0.057	6.1
24.	744.	100.0	23.664 ± 0.034	13.689 ± 0.028	0.934	0.757	0.074	4.9
30.	744.	100.0	23.750 ± 0.041	13.816 ± 0.033	1.117	0.906	0.065	3.0
36.	744.	100.0	23.843 ± 0.047	13.930 ± 0.038	1.275	1.042	0.025	0.9
42.	744.	100.0	23.939 ± 0.052	14.030 ± 0.043	1.406	1.165	-0.035	-1.0
48.	744.	100.0	24.041 ± 0.056	14.118 ± 0.047	1.514	1.280	-0.110	-2.8
54.	740.	99.5	24.134 ± 0.059	14.219 ± 0.050	1.599	1.357	-0.131	-2.9
60.	732.	98.4	24.224 ± 0.061	14.332 ± 0.052	1.655	1.405	-0.076	-1.6
66.	728.	97.8	24.336 ± 0.064	14.422 ± 0.054	1.720	1.466	-0.041	-0.8
72.	719.	96.6	24.444 ± 0.066	14.532 ± 0.056	1.770	1.501	0.087	1.6
78.	713.	95.8	24.565 ± 0.068	14.630 ± 0.058	1.818	1.555	0.217	3.8
84.	706.	94.9	24.681 ± 0.069	14.719 ± 0.060	1.845	1.607	0.297	5.0
90.	699.	94.0	24.781 ± 0.071	14.810 ± 0.062	1.885	1.649	0.456	7.3
96.	694.	93.3	24.884 ± 0.073	14.896 ± 0.064	1.935	1.691	0.621	9.4

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: JJL HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1484.945	100.0	1.996	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	1250.833	84.2	1.681	23.436 ± 0.004	13.180 ± 0.003	0.131	0.106	0.002	7.6
6.	1054.575	71.0	1.417	23.465 ± 0.008	13.254 ± 0.007	0.259	0.212	0.009	7.6
9.	887.482	59.8	1.193	23.497 ± 0.013	13.329 ± 0.011	0.382	0.316	0.020	7.7
12.	746.544	50.3	1.003	23.532 ± 0.018	13.405 ± 0.015	0.497	0.417	0.035	8.0
18.	533.249	35.9	0.717	23.609 ± 0.031	13.551 ± 0.026	0.710	0.600	0.072	8.1
24.	379.978	25.6	0.511	23.692 ± 0.046	13.685 ± 0.039	0.904	0.764	0.109	7.6
30.	267.474	18.0	0.360	23.772 ± 0.066	13.800 ± 0.056	1.079	0.908	0.141	6.9
36.	186.116	12.5	0.250	23.847 ± 0.091	13.889 ± 0.075	1.237	1.030	0.157	5.9
42.	129.394	8.7	0.174	23.916 ± 0.121	13.965 ± 0.099	1.379	1.126	0.143	4.3
48.	90.277	6.1	0.121	23.978 ± 0.158	14.034 ± 0.127	1.502	1.209	0.089	2.3
54.	62.733	4.2	0.085	24.020 ± 0.201	14.118 ± 0.159	1.593	1.263	0.046	1.0
60.	43.594	2.9	0.060	24.062 ± 0.251	14.219 ± 0.197	1.654	1.300	0.043	0.9
66.	30.523	2.1	0.042	24.132 ± 0.312	14.305 ± 0.246	1.722	1.357	0.013	0.3
72.	21.240	1.4	0.030	24.213 ± 0.380	14.400 ± 0.307	1.752	1.415	0.011	0.2
78.	14.764	1.0	0.021	24.321 ± 0.463	14.503 ± 0.385	1.780	1.479	-0.012	-0.2
84.	10.115	0.7	0.014	24.427 ± 0.561	14.613 ± 0.477	1.783	1.518	-0.105	-1.9
90.	6.971	0.5	0.010	24.502 ± 0.679	14.696 ± 0.590	1.792	1.558	-0.144	-2.6
96.	4.794	0.3	0.007	24.564 ± 0.832	14.778 ± 0.728	1.822	1.594	-0.140	-2.4

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: JUL HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	142.176	100.0	0.191	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	240.831	169.4	0.324	23.438 ± 0.008	13.180 ± 0.007	0.130	0.106	0.002	8.3
6.	318.503	224.0	0.428	23.468 ± 0.014	13.253 ± 0.012	0.255	0.212	0.010	8.5
9.	375.590	264.2	0.505	23.503 ± 0.019	13.326 ± 0.016	0.371	0.317	0.021	8.8
12.	415.847	292.5	0.559	23.539 ± 0.024	13.399 ± 0.020	0.482	0.418	0.037	9.0
18.	469.820	330.5	0.631	23.611 ± 0.032	13.542 ± 0.028	0.691	0.603	0.076	9.0
24.	470.262	330.8	0.632	23.664 ± 0.041	13.652 ± 0.035	0.880	0.767	0.117	8.6
30.	436.215	306.8	0.586	23.697 ± 0.050	13.729 ± 0.043	1.048	0.899	0.178	9.2
36.	388.190	273.0	0.522	23.730 ± 0.063	13.776 ± 0.051	1.234	1.000	0.247	9.2
42.	340.809	239.7	0.458	23.731 ± 0.075	13.820 ± 0.058	1.385	1.064	0.271	8.0
48.	302.137	212.5	0.406	23.731 ± 0.087	13.898 ± 0.065	1.515	1.126	0.250	6.2
54.	264.760	186.2	0.358	23.683 ± 0.096	13.971 ± 0.071	1.565	1.163	0.137	3.2
60.	228.926	161.0	0.313	23.659 ± 0.106	14.087 ± 0.079	1.603	1.188	0.084	1.9
66.	196.797	138.4	0.270	23.662 ± 0.119	14.182 ± 0.089	1.673	1.255	-0.046	-0.9
72.	168.909	118.8	0.235	23.762 ± 0.128	14.299 ± 0.103	1.658	1.336	-0.266	-5.5
78.	139.752	98.3	0.196	23.884 ± 0.139	14.502 ± 0.122	1.646	1.441	-0.497	-10.4
84.	111.055	78.1	0.157	24.011 ± 0.155	14.722 ± 0.142	1.637	1.495	-0.737	-15.4
90.	88.645	62.3	0.127	24.147 ± 0.178	14.781 ± 0.159	1.679	1.501	-0.807	-16.0
96.	69.937	49.2	0.101	24.151 ± 0.203	14.800 ± 0.186	1.699	1.553	-0.923	-17.7

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: OCT HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	744.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	744.	100.0	23.492 ± 0.006	13.130 ± 0.009	0.162	0.241	0.011	22.3
6.	744.	100.0	23.566 ± 0.012	13.162 ± 0.018	0.330	0.478	0.041	20.6
9.	744.	100.0	23.631 ± 0.018	13.202 ± 0.026	0.504	0.704	0.089	19.3
12.	744.	100.0	23.689 ± 0.025	13.246 ± 0.033	0.680	0.913	0.154	18.4
18.	744.	100.0	23.783 ± 0.037	13.337 ± 0.047	1.014	1.275	0.323	17.4
24.	736.	98.9	23.882 ± 0.049	13.455 ± 0.057	1.317	1.549	0.505	16.2
30.	729.	98.0	23.982 ± 0.059	13.566 ± 0.066	1.601	1.769	0.745	16.2
36.	719.	96.6	24.090 ± 0.069	13.676 ± 0.072	1.857	1.931	1.024	16.5
42.	710.	95.4	24.191 ± 0.078	13.759 ± 0.077	2.082	2.064	1.285	16.5
48.	693.	93.1	24.327 ± 0.085	13.837 ± 0.082	2.236	2.167	1.575	17.5
54.	674.	90.6	24.486 ± 0.090	13.916 ± 0.088	2.349	2.280	1.875	18.8
60.	651.	87.5	24.595 ± 0.096	14.046 ± 0.093	2.442	2.369	1.974	18.3
66.	628.	84.4	24.609 ± 0.099	14.112 ± 0.098	2.474	2.452	2.017	18.2
72.	600.	80.6	24.677 ± 0.101	14.155 ± 0.101	2.477	2.475	1.788	16.2
78.	570.	76.6	24.793 ± 0.105	14.273 ± 0.105	2.512	2.498	1.676	14.9
84.	534.	71.8	24.773 ± 0.109	14.457 ± 0.108	2.526	2.501	1.722	15.1
90.	507.	68.1	24.733 ± 0.112	14.553 ± 0.112	2.533	2.526	1.782	15.5
96.	487.	65.5	24.765 ± 0.117	14.523 ± 0.112	2.592	2.471	1.579	13.2

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: OCT HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1895.675	100.0	2.548	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	1672.947	88.3	2.249	23.491 ± 0.004	13.127 ± 0.006	0.160	0.240	0.011	22.7
6.	1480.996	78.1	1.991	23.563 ± 0.008	13.153 ± 0.012	0.320	0.475	0.040	21.4
9.	1310.406	69.1	1.761	23.624 ± 0.013	13.185 ± 0.019	0.482	0.699	0.083	19.7
12.	1157.583	61.1	1.556	23.675 ± 0.019	13.214 ± 0.027	0.644	0.902	0.138	18.3
18.	899.308	47.4	1.209	23.761 ± 0.032	13.249 ± 0.041	0.950	1.237	0.290	17.8
24.	692.556	36.5	0.941	23.843 ± 0.047	13.281 ± 0.057	1.229	1.503	0.484	17.8
30.	534.256	28.2	0.733	23.894 ± 0.065	13.307 ± 0.075	1.491	1.741	0.721	18.0
36.	407.590	21.5	0.567	23.949 ± 0.085	13.345 ± 0.094	1.725	1.907	0.953	17.8
42.	312.370	16.5	0.440	24.012 ± 0.108	13.357 ± 0.115	1.915	2.026	1.101	16.7
48.	237.683	12.5	0.343	24.097 ± 0.133	13.385 ± 0.136	2.047	2.102	1.220	16.2
54.	181.864	9.6	0.270	24.175 ± 0.160	13.418 ± 0.162	2.163	2.186	1.308	15.6
60.	137.211	7.2	0.211	24.212 ± 0.189	13.505 ± 0.193	2.220	2.264	1.319	15.0
66.	103.779	5.5	0.165	24.214 ± 0.222	13.577 ± 0.231	2.258	2.351	1.443	15.8
72.	77.453	4.1	0.129	24.223 ± 0.252	13.638 ± 0.269	2.220	2.370	1.196	13.6
78.	57.527	3.0	0.101	24.300 ± 0.294	13.761 ± 0.311	2.232	2.358	0.928	10.6
84.	42.014	2.2	0.079	24.331 ± 0.345	13.913 ± 0.353	2.238	2.286	0.770	8.7
90.	31.581	1.7	0.062	24.342 ± 0.403	13.994 ± 0.402	2.265	2.256	0.771	8.5
96.	24.485	1.3	0.050	24.455 ± 0.478	14.045 ± 0.453	2.364	2.240	0.780	8.0

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: OCT HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	118.480	100.0	0.159	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	177.382	149.7	0.238	23.487 ± 0.011	13.119 ± 0.018	0.152	0.234	0.010	22.6
6.	232.073	195.9	0.312	23.555 ± 0.020	13.143 ± 0.031	0.302	0.468	0.034	20.3
9.	277.403	234.1	0.373	23.614 ± 0.027	13.165 ± 0.041	0.455	0.686	0.066	17.6
12.	311.968	263.3	0.419	23.663 ± 0.035	13.170 ± 0.050	0.611	0.877	0.111	16.5
18.	352.194	297.3	0.473	23.753 ± 0.048	13.120 ± 0.062	0.905	1.166	0.279	18.8
24.	368.644	311.1	0.501	23.787 ± 0.060	13.067 ± 0.075	1.160	1.435	0.466	19.1
30.	368.844	311.3	0.506	23.788 ± 0.073	12.993 ± 0.086	1.401	1.659	0.692	19.4
36.	351.420	296.6	0.489	23.798 ± 0.085	12.901 ± 0.094	1.601	1.762	0.888	19.1
42.	334.676	282.5	0.471	23.841 ± 0.098	12.833 ± 0.101	1.786	1.844	1.010	17.6
48.	309.530	261.3	0.447	23.900 ± 0.109	12.787 ± 0.107	1.926	1.980	1.082	16.2
54.	288.892	243.8	0.429	23.954 ± 0.119	12.787 ± 0.114	2.030	1.929	1.160	15.7
60.	264.395	223.2	0.406	24.020 ± 0.127	12.848 ± 0.122	2.064	1.983	1.179	15.5
66.	237.100	200.1	0.378	23.918 ± 0.134	12.849 ± 0.132	2.062	2.040	1.184	15.6
72.	209.381	176.7	0.349	23.891 ± 0.139	12.889 ± 0.141	2.010	2.046	0.950	11.2
78.	181.326	153.0	0.318	23.975 ± 0.155	12.944 ± 0.146	2.082	1.973	0.758	9.9
84.	156.692	132.3	0.293	24.065 ± 0.171	13.090 ± 0.146	2.143	1.830	0.877	10.8
90.	141.271	119.2	0.279	24.173 ± 0.188	13.259 ± 0.152	2.238	1.806	1.268	14.2
96.	132.149	111.5	0.271	24.316 ± 0.206	13.365 ± 0.158	2.364	1.813	1.491	14.9

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7801 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	246.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	246.	100.0	23.405 ± 0.014	12.903 ± 0.021	0.224	0.325	0.000	0.0
6.	246.	100.0	23.401 ± 0.029	12.707 ± 0.039	0.448	0.616	0.007	2.1
9.	246.	100.0	23.386 ± 0.042	12.527 ± 0.056	0.662	0.872	0.047	6.2
12.	246.	100.0	23.354 ± 0.055	12.367 ± 0.070	0.864	1.102	0.135	10.3
18.	246.	100.0	23.249 ± 0.078	12.124 ± 0.095	1.230	1.495	0.412	15.2
24.	245.	99.6	23.107 ± 0.100	12.011 ± 0.115	1.559	1.792	0.708	16.2
30.	241.	98.0	22.929 ± 0.119	12.055 ± 0.128	1.840	1.987	1.052	17.3
36.	235.	95.5	22.813 ± 0.135	12.219 ± 0.138	2.069	2.119	1.126	14.7
42.	232.	94.3	22.663 ± 0.150	12.480 ± 0.144	2.281	2.187	1.034	11.2
48.	226.	91.9	22.556 ± 0.162	12.834 ± 0.150	2.440	2.260	0.844	8.1
54.	220.	89.4	22.392 ± 0.174	13.307 ± 0.152	2.581	2.259	0.718	6.1
60.	216.	87.8	22.232 ± 0.184	13.806 ± 0.153	2.705	2.248	0.583	4.6
66.	215.	87.4	22.175 ± 0.195	14.233 ± 0.158	2.855	2.315	0.163	1.1
72.	215.	87.4	22.142 ± 0.203	14.696 ± 0.162	2.982	2.377	-0.290	-1.9
78.	211.	85.8	22.097 ± 0.209	15.176 ± 0.158	3.034	2.293	-0.258	-1.6
84.	207.	84.1	22.158 ± 0.218	15.551 ± 0.156	3.136	2.240	-0.471	-2.7
90.	199.	80.9	22.156 ± 0.219	15.896 ± 0.154	3.082	2.172	-0.547	-3.3
96.	190.	77.2	22.231 ± 0.230	16.282 ± 0.144	3.166	1.982	-0.677	-3.9

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7801 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1013.320	100.0	4.119	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	874.917	86.3	3.557	23.408 ± 0.009	12.901 ± 0.011	0.223	0.325	0.001	0.6
6.	754.850	74.5	3.068	23.412 ± 0.016	12.700 ± 0.022	0.442	0.612	0.011	3.3
9.	652.452	64.4	2.652	23.408 ± 0.026	12.513 ± 0.034	0.652	0.864	0.057	7.6
12.	565.278	55.8	2.298	23.390 ± 0.036	12.345 ± 0.046	0.852	1.089	0.151	11.7
18.	425.661	42.0	1.730	23.311 ± 0.060	12.086 ± 0.071	1.231	1.466	0.444	16.3
24.	319.138	31.5	1.303	23.196 ± 0.089	11.956 ± 0.098	1.591	1.755	0.789	17.3
30.	235.758	23.3	0.978	23.081 ± 0.124	12.007 ± 0.127	1.904	1.955	1.153	17.6
36.	173.205	17.1	0.737	23.026 ± 0.164	12.166 ± 0.161	2.163	2.122	1.338	16.0
42.	128.346	12.7	0.553	22.953 ± 0.212	12.450 ± 0.197	2.406	2.227	1.374	13.3
48.	94.249	9.3	0.417	22.892 ± 0.270	12.874 ± 0.238	2.619	2.308	1.299	10.7
54.	69.024	6.8	0.314	22.784 ± 0.337	13.428 ± 0.275	2.803	2.284	1.309	9.5
60.	51.047	5.0	0.236	22.713 ± 0.413	14.003 ± 0.307	2.948	2.196	1.286	8.4
66.	38.180	3.8	0.178	22.773 ± 0.503	14.457 ± 0.350	3.109	2.163	0.866	5.1
72.	28.505	2.8	0.133	22.816 ± 0.608	14.863 ± 0.397	3.246	2.122	0.447	2.4
78.	20.657	2.0	0.098	22.792 ± 0.725	15.303 ± 0.432	3.294	1.965	0.609	3.2
84.	15.317	1.5	0.074	22.835 ± 0.864	15.687 ± 0.488	3.380	1.909	0.301	1.5
90.	11.311	1.1	0.057	22.853 ± 0.997	16.045 ± 0.558	3.352	1.876	-0.035	-0.2
96.	8.288	0.8	0.044	22.925 ± 1.168	16.378 ± 0.620	3.364	1.784	-0.363	-1.8

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7801 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	47.010	100.0	0.191	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	60.035	127.7	0.244	23.421 ± 0.028	12.894 ± 0.041	0.216	0.321	0.003	3.4
6.	71.318	151.7	0.290	23.441 ± 0.051	12.678 ± 0.071	0.427	0.602	0.022	6.8
9.	80.942	172.2	0.329	23.447 ± 0.070	12.475 ± 0.094	0.631	0.844	0.085	12.8
12.	88.406	188.1	0.359	23.438 ± 0.089	12.286 ± 0.113	0.834	1.058	0.198	15.9
18.	99.456	211.6	0.404	23.381 ± 0.123	12.014 ± 0.143	1.225	1.427	0.515	18.9
24.	102.420	217.9	0.418	23.309 ± 0.159	11.881 ± 0.171	1.606	1.730	0.884	18.9
30.	98.978	210.5	0.411	23.289 ± 0.196	11.919 ± 0.197	1.951	1.957	1.239	18.0
36.	91.417	194.5	0.389	23.288 ± 0.239	12.061 ± 0.225	2.290	2.149	1.522	16.2
42.	82.866	176.3	0.357	23.326 ± 0.285	12.397 ± 0.254	2.597	2.315	1.629	13.6
48.	73.377	156.1	0.325	23.412 ± 0.338	12.925 ± 0.282	2.893	2.414	1.640	11.1
54.	65.849	140.1	0.299	23.449 ± 0.389	13.503 ± 0.289	3.159	2.348	1.896	10.8
60.	58.279	124.0	0.270	23.575 ± 0.442	14.217 ± 0.283	3.377	2.158	1.982	9.9
66.	51.198	108.9	0.238	23.945 ± 0.500	14.753 ± 0.287	3.574	2.051	1.256	5.6
72.	43.069	91.6	0.200	24.117 ± 0.566	15.053 ± 0.308	3.716	2.023	0.727	3.0
78.	34.911	74.3	0.165	24.118 ± 0.632	15.548 ± 0.303	3.737	1.789	0.920	3.8
84.	31.382	66.8	0.152	24.166 ± 0.580	15.839 ± 0.317	3.812	1.778	0.570	2.2
90.	28.108	59.8	0.141	24.137 ± 0.715	16.078 ± 0.339	3.791	1.795	0.245	1.0
96.	24.024	51.1	0.126	24.090 ± 0.753	16.385 ± 0.326	3.690	1.600	-0.191	-0.8

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7807 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	248.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	248.	100.0	23.442 ± 0.007	13.179 ± 0.007	0.106	0.105	0.002	10.0
6.	248.	100.0	23.480 ± 0.013	13.252 ± 0.013	0.210	0.207	0.007	9.5
9.	248.	100.0	23.524 ± 0.020	13.329 ± 0.019	0.311	0.307	0.016	9.3
12.	248.	100.0	23.574 ± 0.026	13.408 ± 0.026	0.407	0.403	0.027	9.2
18.	248.	100.0	23.693 ± 0.037	13.565 ± 0.037	0.581	0.581	0.054	9.1
24.	248.	100.0	23.839 ± 0.047	13.720 ± 0.047	0.740	0.747	0.092	9.6
30.	248.	100.0	24.007 ± 0.056	13.870 ± 0.057	0.889	0.903	0.152	10.9
36.	248.	100.0	24.187 ± 0.065	14.014 ± 0.066	1.030	1.046	0.246	13.1
42.	248.	100.0	24.368 ± 0.074	14.152 ± 0.074	1.160	1.171	0.377	15.7
48.	248.	100.0	24.545 ± 0.081	14.290 ± 0.081	1.280	1.281	0.528	17.8
54.	248.	100.0	24.717 ± 0.088	14.428 ± 0.087	1.391	1.374	0.667	19.0
60.	248.	100.0	24.887 ± 0.095	14.560 ± 0.092	1.489	1.452	0.774	19.2
66.	248.	100.0	25.060 ± 0.100	14.684 ± 0.097	1.572	1.522	0.848	19.0
72.	248.	100.0	25.242 ± 0.104	14.796 ± 0.101	1.641	1.592	0.919	18.8
78.	248.	100.0	25.433 ± 0.108	14.897 ± 0.106	1.697	1.666	1.008	19.3
84.	248.	100.0	25.626 ± 0.111	14.986 ± 0.111	1.742	1.740	1.129	20.4
90.	248.	100.0	25.817 ± 0.113	15.070 ± 0.115	1.787	1.810	1.296	22.1
96.	248.	100.0	25.999 ± 0.117	15.158 ± 0.119	1.838	1.876	1.529	24.4

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7807 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	494.982	100.0	1.996	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	413.897	83.6	1.669	23.442 ± 0.005	13.180 ± 0.005	0.106	0.104	0.002	9.6
6.	348.038	70.3	1.403	23.482 ± 0.011	13.255 ± 0.011	0.211	0.206	0.007	8.8
9.	293.405	59.3	1.183	23.529 ± 0.018	13.336 ± 0.018	0.311	0.306	0.014	8.1
12.	247.653	50.0	0.999	23.583 ± 0.026	13.419 ± 0.026	0.405	0.403	0.022	7.7
18.	177.607	35.9	0.716	23.714 ± 0.043	13.586 ± 0.044	0.570	0.587	0.044	7.8
24.	127.033	25.7	0.512	23.876 ± 0.063	13.746 ± 0.067	0.714	0.760	0.085	9.4
30.	89.696	18.1	0.362	24.056 ± 0.090	13.891 ± 0.097	0.851	0.915	0.164	12.8
36.	62.037	12.5	0.250	24.235 ± 0.125	14.016 ± 0.133	0.982	1.046	0.290	16.8
42.	41.980	8.5	0.169	24.421 ± 0.173	14.119 ± 0.176	1.121	1.140	0.456	19.9
48.	28.041	5.7	0.113	24.603 ± 0.239	14.208 ± 0.229	1.259	1.211	0.643	22.1
54.	18.528	3.7	0.075	24.751 ± 0.319	14.292 ± 0.298	1.374	1.281	0.798	22.9
60.	12.334	2.5	0.050	24.895 ± 0.420	14.379 ± 0.387	1.476	1.357	0.890	22.2
66.	8.291	1.7	0.033	25.053 ± 0.544	14.462 ± 0.497	1.565	1.432	0.944	21.0
72.	5.590	1.1	0.023	25.216 ± 0.696	14.520 ± 0.638	1.645	1.509	0.994	20.2
78.	3.772	0.8	0.015	25.393 ± 0.883	14.580 ± 0.819	1.716	1.591	1.039	19.4
84.	2.515	0.5	0.010	25.567 ± 1.105	14.620 ± 1.043	1.752	1.654	1.015	18.3
90.	1.686	0.3	0.007	25.736 ± 1.375	14.621 ± 1.293	1.785	1.679	0.952	16.6
96.	1.118	0.2	0.005	25.909 ± 1.744	14.655 ± 1.602	1.844	1.694	0.990	16.2

SOURCE STATION IS: 20 - ILL BALDWIN PERIOD: 7807 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	47.392	100.0	0.191	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	79.229	167.2	0.319	23.444 ± 0.012	13.180 ± 0.011	0.107	0.102	0.002	8.5
6.	105.634	222.9	0.426	23.484 ± 0.021	13.257 ± 0.020	0.211	0.203	0.006	7.6
9.	127.806	269.7	0.515	23.532 ± 0.027	13.339 ± 0.027	0.310	0.302	0.011	6.5
12.	143.694	303.2	0.579	23.583 ± 0.034	13.422 ± 0.033	0.404	0.397	0.017	5.8
18.	163.599	345.2	0.660	23.705 ± 0.044	13.583 ± 0.046	0.564	0.586	0.034	6.1
24.	163.031	344.0	0.657	23.842 ± 0.056	13.723 ± 0.059	0.710	0.758	0.083	9.3
30.	151.405	319.5	0.611	23.996 ± 0.069	13.841 ± 0.074	0.850	0.908	0.185	14.3
36.	130.530	275.4	0.526	24.177 ± 0.090	13.948 ± 0.090	1.032	1.023	0.374	19.4
42.	102.475	216.2	0.413	24.328 ± 0.119	13.965 ± 0.106	1.206	1.075	0.635	23.6
48.	82.446	174.0	0.332	24.477 ± 0.152	14.042 ± 0.125	1.383	1.136	0.892	25.0
54.	64.313	135.7	0.259	24.470 ± 0.175	14.033 ± 0.148	1.407	1.190	0.849	23.2
60.	51.630	108.9	0.208	24.511 ± 0.202	14.038 ± 0.170	1.453	1.224	0.699	18.3
66.	39.370	83.1	0.159	24.555 ± 0.236	14.017 ± 0.197	1.483	1.238	0.498	12.8
72.	30.948	65.3	0.125	24.702 ± 0.268	13.895 ± 0.223	1.490	1.242	0.164	4.2
78.	25.392	53.6	0.102	24.962 ± 0.301	13.988 ± 0.275	1.516	1.385	0.063	1.6
84.	19.644	41.4	0.079	25.141 ± 0.349	13.967 ± 0.330	1.549	1.462	-0.000	-0.0
90.	15.169	32.0	0.061	25.467 ± 0.424	13.919 ± 0.387	1.651	1.508	-0.075	-1.6
96.	11.949	25.2	0.048	25.757 ± 0.510	13.880 ± 0.448	1.762	1.549	0.512	9.4

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1978 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2872.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	2872.	100.0	26.208 ± 0.004	13.633 ± 0.004	0.213	0.232	0.003	1.8
6.	2872.	100.0	26.251 ± 0.009	13.623 ± 0.009	0.414	0.450	0.014	4.6
9.	2872.	100.0	26.290 ± 0.011	13.619 ± 0.012	0.601	0.651	0.034	5.3
12.	2872.	100.0	26.323 ± 0.015	13.619 ± 0.016	0.777	0.840	0.063	5.9
18.	2867.	99.8	26.374 ± 0.021	13.629 ± 0.022	1.101	1.164	0.154	7.2
24.	2858.	99.5	26.406 ± 0.026	13.649 ± 0.027	1.400	1.430	0.307	8.9
30.	2844.	99.0	26.423 ± 0.031	13.677 ± 0.031	1.675	1.644	0.530	10.7
36.	2808.	97.8	26.414 ± 0.036	13.714 ± 0.034	1.908	1.800	0.793	12.3
42.	2749.	95.7	26.374 ± 0.040	13.737 ± 0.036	2.100	1.908	1.028	13.1
48.	2684.	93.5	26.325 ± 0.044	13.767 ± 0.038	2.260	1.985	1.282	14.1
54.	2604.	90.7	26.273 ± 0.047	13.826 ± 0.040	2.384	2.032	1.506	14.8
60.	2538.	88.4	26.254 ± 0.050	13.912 ± 0.041	2.515	2.073	1.683	14.9
66.	2460.	85.7	26.175 ± 0.052	13.986 ± 0.043	2.592	2.139	1.889	15.7
72.	2389.	83.2	26.132 ± 0.055	14.068 ± 0.044	2.677	2.171	1.881	14.7
78.	2319.	80.7	26.107 ± 0.058	14.207 ± 0.045	2.778	2.180	1.835	13.4
84.	2254.	78.5	26.082 ± 0.060	14.305 ± 0.047	2.840	2.212	1.620	11.4
90.	2180.	75.9	26.014 ± 0.062	14.391 ± 0.048	2.904	2.255	1.487	10.0
96.	2103.	73.2	26.017 ± 0.064	14.476 ± 0.050	2.956	2.279	1.385	9.0

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1978 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	7978.269	100.0	2.778	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	6811.842	85.4	2.372	26.215 ± 0.003	13.619 ± 0.003	0.220	0.238	0.001	1.6
6.	5870.554	73.6	2.044	26.269 ± 0.006	13.590 ± 0.006	0.425	0.459	0.009	2.7
9.	5081.598	63.7	1.769	26.319 ± 0.009	13.562 ± 0.009	0.615	0.663	0.024	3.6
12.	4410.612	55.3	1.536	26.364 ± 0.012	13.532 ± 0.013	0.794	0.851	0.049	4.4
18.	3333.223	41.8	1.163	26.428 ± 0.019	13.472 ± 0.020	1.122	1.166	0.135	6.1
24.	2518.635	31.6	0.881	26.459 ± 0.029	13.413 ± 0.028	1.427	1.418	0.291	8.1
30.	1899.229	23.8	0.668	26.458 ± 0.039	13.362 ± 0.037	1.709	1.616	0.520	10.1
36.	1419.898	17.8	0.506	26.429 ± 0.052	13.336 ± 0.046	1.957	1.743	0.788	11.6
42.	1048.023	13.1	0.381	26.362 ± 0.067	13.291 ± 0.056	2.160	1.822	1.011	12.2
48.	771.779	9.7	0.288	26.282 ± 0.084	13.248 ± 0.067	2.327	1.872	1.219	12.7
54.	564.420	7.1	0.217	26.182 ± 0.103	13.240 ± 0.079	2.452	1.866	1.318	12.4
60.	415.712	5.2	0.164	26.104 ± 0.127	13.265 ± 0.092	2.585	1.868	1.357	11.5
66.	302.930	3.8	0.123	25.925 ± 0.151	13.282 ± 0.107	2.635	1.866	1.352	11.0
72.	223.516	2.8	0.094	25.816 ± 0.181	13.339 ± 0.126	2.704	1.880	1.292	10.0
78.	165.012	2.1	0.071	25.726 ± 0.217	13.439 ± 0.147	2.788	1.883	1.153	8.4
84.	121.989	1.5	0.054	25.674 ± 0.255	13.504 ± 0.171	2.831	1.886	0.770	5.5
90.	89.223	1.1	0.041	25.582 ± 0.299	13.567 ± 0.202	2.829	1.910	0.455	3.3
96.	65.900	0.8	0.031	25.537 ± 0.347	13.633 ± 0.237	2.817	1.926	0.250	1.8

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1978 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	502.424	100.0	0.175	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	708.592	141.0	0.247	26.218 ± 0.007	13.623 ± 0.008	0.199	0.217	0.004	6.3
6.	897.022	178.5	0.312	26.276 ± 0.013	13.600 ± 0.014	0.379	0.414	0.018	7.3
9.	1049.632	208.9	0.365	26.333 ± 0.017	13.575 ± 0.019	0.545	0.589	0.043	8.2
12.	1166.298	232.1	0.406	26.386 ± 0.021	13.544 ± 0.022	0.708	0.743	0.079	9.0
18.	1314.041	261.5	0.458	26.472 ± 0.029	13.477 ± 0.028	1.015	1.000	0.194	10.7
24.	1359.127	270.5	0.476	26.539 ± 0.035	13.405 ± 0.033	1.297	1.206	0.379	12.7
30.	1354.275	269.5	0.476	26.601 ± 0.042	13.361 ± 0.038	1.561	1.383	0.617	14.2
36.	1294.863	257.7	0.461	26.678 ± 0.050	13.351 ± 0.042	1.809	1.516	0.885	15.1
42.	1186.375	236.1	0.432	26.704 ± 0.059	13.319 ± 0.047	1.993	1.604	1.030	14.5
48.	1068.177	212.6	0.398	26.704 ± 0.066	13.265 ± 0.051	2.143	1.652	1.121	13.7
54.	954.350	189.9	0.366	26.717 ± 0.074	13.256 ± 0.055	2.291	1.687	1.226	13.2
60.	837.153	166.6	0.330	26.748 ± 0.084	13.259 ± 0.059	2.417	1.694	1.294	12.5
66.	717.083	142.7	0.291	26.544 ± 0.092	13.266 ± 0.063	2.457	1.692	1.298	12.1
72.	628.133	125.0	0.263	26.615 ± 0.101	13.335 ± 0.068	2.532	1.699	1.355	11.9
78.	542.844	108.0	0.234	26.626 ± 0.114	13.403 ± 0.073	2.661	1.700	1.496	11.9
84.	456.354	90.8	0.202	26.566 ± 0.125	13.393 ± 0.078	2.669	1.672	1.160	9.2
90.	384.706	76.6	0.176	26.543 ± 0.135	13.427 ± 0.084	2.652	1.650	0.950	7.7
96.	334.893	66.7	0.159	26.508 ± 0.143	13.505 ± 0.091	2.620	1.668	0.811	6.7

SOURCE STATION IS: 24 - PEN CONMJO ALLEG PERIOD: 1979 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2886.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	2886.	100.0	26.219 ± 0.004	13.668 ± 0.005	0.200	0.259	0.010	13.9
6.	2886.	100.0	26.267 ± 0.008	13.691 ± 0.009	0.404	0.508	0.043	14.8
9.	2877.	99.7	26.303 ± 0.011	13.726 ± 0.014	0.602	0.734	0.110	17.0
12.	2862.	99.2	26.332 ± 0.015	13.772 ± 0.018	0.794	0.936	0.213	18.6
18.	2783.	96.4	26.355 ± 0.021	13.899 ± 0.024	1.117	1.260	0.488	21.4
24.	2665.	92.3	26.332 ± 0.027	14.049 ± 0.029	1.369	1.519	0.794	23.0
30.	2560.	88.7	26.305 ± 0.031	14.206 ± 0.034	1.592	1.734	1.104	23.5
36.	2436.	84.4	26.254 ± 0.036	14.364 ± 0.039	1.783	1.901	1.413	24.0
42.	2317.	80.3	26.171 ± 0.041	14.511 ± 0.042	1.961	2.021	1.698	23.8
48.	2202.	76.3	26.056 ± 0.045	14.630 ± 0.045	2.107	2.105	1.915	23.3
54.	2083.	72.2	25.923 ± 0.049	14.694 ± 0.047	2.226	2.134	2.016	22.1
60.	1985.	68.8	25.821 ± 0.053	14.709 ± 0.049	2.348	2.170	2.114	21.0
66.	1892.	65.6	25.738 ± 0.057	14.765 ± 0.050	2.464	2.184	2.103	19.1
72.	1788.	62.0	25.601 ± 0.059	14.776 ± 0.052	2.513	2.198	1.948	17.1
78.	1691.	58.6	25.489 ± 0.061	14.774 ± 0.054	2.519	2.230	1.792	15.8
84.	1611.	55.8	25.414 ± 0.063	14.750 ± 0.056	2.532	2.240	1.696	14.8
90.	1512.	52.4	25.350 ± 0.064	14.734 ± 0.056	2.483	2.196	1.723	15.6
96.	1439.	49.9	25.300 ± 0.065	14.792 ± 0.058	2.465	2.193	1.667	15.3

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1979 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8024.939	100.0	2.781	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	6879.127	85.7	2.384	26.219 ± 0.003	13.660 ± 0.003	0.212	0.277	0.009	11.9
6.	5940.416	74.0	2.058	26.268 ± 0.005	13.674 ± 0.007	0.426	0.542	0.040	12.6
9.	5125.737	63.9	1.782	26.305 ± 0.009	13.701 ± 0.011	0.633	0.780	0.109	15.2
12.	4410.482	55.0	1.541	26.332 ± 0.013	13.743 ± 0.015	0.833	0.987	0.218	17.4
18.	3198.151	39.9	1.149	26.338 ± 0.021	13.869 ± 0.023	1.165	1.309	0.510	20.6
24.	2282.961	28.4	0.857	26.283 ± 0.030	14.012 ± 0.032	1.422	1.550	0.812	21.9
30.	1637.104	20.4	0.639	26.209 ± 0.041	14.149 ± 0.043	1.644	1.747	1.119	22.5
36.	1158.980	14.4	0.476	26.108 ± 0.053	14.261 ± 0.055	1.812	1.889	1.395	23.0
42.	821.380	10.2	0.355	25.978 ± 0.069	14.345 ± 0.070	1.974	2.006	1.675	23.3
48.	581.303	7.2	0.264	25.829 ± 0.088	14.405 ± 0.087	2.117	2.108	1.946	23.5
54.	409.272	5.1	0.196	25.672 ± 0.110	14.421 ± 0.106	2.225	2.149	2.117	23.2
60.	292.021	3.6	0.147	25.591 ± 0.136	14.443 ± 0.130	2.332	2.216	2.315	23.1
66.	208.543	2.6	0.110	25.534 ± 0.169	14.524 ± 0.156	2.445	2.260	2.373	21.7
72.	149.142	1.9	0.083	25.387 ± 0.202	14.522 ± 0.189	2.472	2.306	2.171	19.6
78.	107.807	1.3	0.064	25.254 ± 0.237	14.512 ± 0.226	2.461	2.347	1.868	17.1
84.	79.311	1.0	0.049	25.144 ± 0.277	14.463 ± 0.264	2.463	2.355	1.697	15.6
90.	57.818	0.7	0.038	25.151 ± 0.321	14.437 ± 0.302	2.442	2.296	1.939	18.0
96.	42.853	0.5	0.030	25.102 ± 0.371	14.462 ± 0.352	2.429	2.303	1.977	18.5

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1979 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	504.876	100.0	0.175	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	712.648	141.2	0.247	26.222 ± 0.007	13.661 ± 0.009	0.191	0.246	0.010	14.8
6.	894.097	177.1	0.310	26.275 ± 0.013	13.680 ± 0.016	0.380	0.474	0.039	15.1
9.	1036.840	205.4	0.360	26.319 ± 0.019	13.702 ± 0.021	0.564	0.678	0.097	16.8
12.	1138.072	225.4	0.398	26.352 ± 0.022	13.730 ± 0.025	0.745	0.854	0.184	18.3
18.	1224.458	242.5	0.440	26.380 ± 0.030	13.795 ± 0.032	1.062	1.130	0.419	20.4
24.	1201.382	238.0	0.451	26.346 ± 0.038	13.873 ± 0.039	1.316	1.359	0.712	22.4
30.	1127.503	223.3	0.440	26.295 ± 0.046	13.916 ± 0.046	1.539	1.546	0.996	22.8
36.	1001.579	198.4	0.411	26.214 ± 0.055	13.904 ± 0.053	1.739	1.670	1.308	23.4
42.	859.335	170.2	0.371	26.119 ± 0.065	13.871 ± 0.062	1.893	1.809	1.650	24.7
48.	726.569	143.9	0.330	26.025 ± 0.077	13.828 ± 0.070	2.071	1.885	2.001	25.0
54.	606.827	120.2	0.291	25.963 ± 0.091	13.846 ± 0.079	2.241	1.936	2.443	25.9
60.	514.180	101.8	0.259	25.991 ± 0.103	13.919 ± 0.089	2.344	2.027	2.818	27.2
66.	434.875	86.1	0.230	26.019 ± 0.119	13.985 ± 0.101	2.455	2.105	3.021	26.6
72.	363.744	72.0	0.203	25.922 ± 0.132	13.926 ± 0.112	2.517	2.142	3.082	25.9
78.	310.628	61.5	0.194	25.785 ± 0.145	13.876 ± 0.123	2.562	2.169	3.061	25.0
84.	264.593	52.4	0.164	25.622 ± 0.159	13.827 ± 0.135	2.577	2.199	3.041	24.6
90.	227.973	45.2	0.151	25.485 ± 0.171	13.772 ± 0.149	2.584	2.231	3.223	25.8
96.	196.666	39.0	0.137	25.343 ± 0.184	13.724 ± 0.164	2.583	2.298	3.293	26.3

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1980 HEIGHT: SFC (UNWEIGHTED)

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	2894.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	2894.	100.0	26.215 ± 0.003	13.634 ± 0.004	0.186	0.236	0.012	19.2
6.	2894.	100.0	26.259 ± 0.007	13.627 ± 0.009	0.372	0.464	0.049	19.3
9.	2892.	99.9	26.292 ± 0.010	13.628 ± 0.013	0.557	0.680	0.109	19.3
12.	2884.	99.7	26.313 ± 0.014	13.639 ± 0.016	0.735	0.875	0.197	20.0
18.	2827.	97.7	26.316 ± 0.020	13.673 ± 0.022	1.061	1.189	0.447	21.7
24.	2765.	95.5	26.293 ± 0.026	13.719 ± 0.027	1.354	1.437	0.746	22.2
30.	2661.	91.9	26.256 ± 0.031	13.801 ± 0.032	1.598	1.629	1.034	22.0
36.	2515.	86.9	26.198 ± 0.035	13.888 ± 0.035	1.783	1.764	1.261	21.6
42.	2375.	82.1	26.128 ± 0.040	13.935 ± 0.039	1.925	1.884	1.458	21.5
48.	2238.	77.3	26.091 ± 0.043	13.992 ± 0.042	2.026	1.979	1.550	20.7
54.	2076.	71.7	25.999 ± 0.047	14.028 ± 0.045	2.121	2.028	1.527	18.7
60.	1922.	66.4	25.919 ± 0.050	14.090 ± 0.047	2.196	2.050	1.411	16.3
66.	1786.	61.7	25.849 ± 0.053	14.146 ± 0.048	2.261	2.048	1.180	13.0
72.	1661.	57.4	25.729 ± 0.057	14.207 ± 0.051	2.327	2.080	0.998	10.4
78.	1555.	53.7	25.635 ± 0.061	14.257 ± 0.054	2.397	2.146	0.931	9.2
84.	1449.	50.1	25.532 ± 0.065	14.314 ± 0.057	2.472	2.174	0.950	8.8
90.	1363.	47.1	25.470 ± 0.068	14.340 ± 0.060	2.524	2.197	1.161	10.3
96.	1292.	44.6	25.454 ± 0.072	14.389 ± 0.062	2.579	2.218	1.224	10.4

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1980 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	8057.893	100.0	2.784	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	6986.198	86.7	2.414	26.212 ± 0.002	13.628 ± 0.003	0.193	0.244	0.015	21.6
6.	6076.060	75.4	2.100	26.251 ± 0.005	13.613 ± 0.006	0.384	0.479	0.059	21.9
9.	5287.876	65.6	1.828	26.277 ± 0.008	13.602 ± 0.010	0.571	0.702	0.130	21.8
12.	4591.443	57.0	1.592	26.290 ± 0.011	13.598 ± 0.013	0.751	0.904	0.231	22.3
18.	3415.628	42.4	1.208	26.267 ± 0.019	13.606 ± 0.021	1.083	1.230	0.511	23.6
24.	2527.410	31.4	0.914	26.204 ± 0.027	13.618 ± 0.029	1.382	1.480	0.836	23.6
30.	1832.611	22.7	0.689	26.117 ± 0.038	13.659 ± 0.039	1.627	1.663	1.132	23.2
36.	1297.231	16.1	0.516	26.017 ± 0.050	13.712 ± 0.049	1.810	1.775	1.351	22.4
42.	917.700	11.4	0.386	25.901 ± 0.064	13.714 ± 0.062	1.931	1.884	1.535	22.4
48.	654.447	8.1	0.292	25.833 ± 0.080	13.720 ± 0.077	2.041	1.979	1.673	21.9
54.	458.198	5.7	0.221	25.694 ± 0.098	13.662 ± 0.094	2.099	2.011	1.553	19.4
60.	320.000	4.0	0.166	25.590 ± 0.121	13.687 ± 0.114	2.168	2.035	1.421	16.8
66.	224.353	2.8	0.126	25.493 ± 0.152	13.734 ± 0.139	2.274	2.066	1.268	13.8
72.	155.784	1.9	0.094	25.357 ± 0.189	13.796 ± 0.170	2.362	2.117	1.035	10.5
78.	108.570	1.3	0.070	25.228 ± 0.234	13.831 ± 0.212	2.438	2.206	0.907	8.7
84.	75.033	0.9	0.052	25.091 ± 0.290	13.864 ± 0.257	2.515	2.223	0.829	7.5
90.	51.959	0.6	0.038	24.977 ± 0.347	13.823 ± 0.304	2.499	2.191	0.915	8.3
96.	37.284	0.5	0.029	24.993 ± 0.416	13.892 ± 0.359	2.540	2.192	0.912	8.0

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: JAN HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	738.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	738.	100.0	26.238 ± 0.010	13.590 ± 0.012	0.265	0.336	-0.003	-2.6
6.	738.	100.0	26.301 ± 0.019	13.532 ± 0.024	0.511	0.656	-0.010	-2.1
9.	729.	98.8	26.333 ± 0.027	13.495 ± 0.035	0.724	0.940	0.008	0.9
12.	718.	97.3	26.344 ± 0.034	13.464 ± 0.045	0.912	1.200	0.035	2.6
18.	665.	90.1	26.280 ± 0.049	13.461 ± 0.061	1.253	1.570	0.146	5.3
24.	631.	85.5	26.208 ± 0.062	13.440 ± 0.073	1.565	1.931	0.199	4.6
30.	592.	80.2	26.122 ± 0.075	13.442 ± 0.085	1.817	2.061	0.278	4.8
36.	547.	74.1	25.953 ± 0.085	13.372 ± 0.094	2.015	2.210	0.398	5.6
42.	514.	69.6	25.762 ± 0.098	13.278 ± 0.107	2.224	2.318	0.697	8.0
48.	494.	66.9	25.595 ± 0.109	13.196 ± 0.109	2.410	2.427	1.186	11.5
54.	464.	62.9	25.406 ± 0.118	13.152 ± 0.111	2.540	2.401	1.593	13.9
60.	441.	59.8	25.257 ± 0.131	13.099 ± 0.114	2.753	2.402	2.029	15.0
66.	416.	56.4	24.930 ± 0.138	13.102 ± 0.120	2.815	2.439	2.406	16.9
72.	394.	53.4	24.660 ± 0.147	13.218 ± 0.127	2.911	2.523	2.636	17.3
78.	370.	50.1	24.411 ± 0.149	13.445 ± 0.130	2.869	2.508	2.369	16.1
84.	358.	48.5	24.202 ± 0.152	13.571 ± 0.133	2.870	2.515	1.603	11.0
90.	335.	45.4	24.067 ± 0.152	13.690 ± 0.136	2.777	2.481	1.464	10.7
96.	325.	44.0	24.049 ± 0.153	13.786 ± 0.139	2.762	2.500	1.345	10.0

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: JAN HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	3039.960	100.0	4.119	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	2598.308	85.5	3.521	26.240 ± 0.005	13.588 ± 0.007	0.262	0.334	-0.003	-2.8
6.	2242.291	73.8	3.038	26.306 ± 0.011	13.528 ± 0.014	0.500	0.649	-0.014	-3.1
9.	1916.048	63.0	2.628	26.342 ± 0.016	13.485 ± 0.021	0.705	0.922	-0.006	-0.7
12.	1633.152	53.7	2.275	26.359 ± 0.022	13.449 ± 0.029	0.889	1.167	0.009	0.7
18.	1145.214	37.7	1.722	26.312 ± 0.036	13.452 ± 0.045	1.233	1.523	0.116	4.4
24.	824.234	27.1	1.306	26.253 ± 0.054	13.434 ± 0.062	1.542	1.784	0.162	3.9
30.	582.578	19.2	0.984	26.166 ± 0.074	13.430 ± 0.083	1.776	2.013	0.205	3.7
36.	409.178	13.5	0.748	25.986 ± 0.097	13.331 ± 0.107	1.972	2.174	0.321	4.7
42.	292.031	9.6	0.568	25.768 ± 0.125	13.205 ± 0.135	2.160	2.300	0.612	7.5
48.	211.468	7.0	0.428	25.578 ± 0.161	13.104 ± 0.166	2.343	2.418	1.062	10.9
54.	150.219	4.9	0.324	25.376 ± 0.204	13.031 ± 0.194	2.504	2.375	1.410	12.7
60.	107.126	3.5	0.243	25.201 ± 0.261	12.977 ± 0.227	2.705	2.354	1.763	13.5
66.	75.559	2.5	0.182	24.859 ± 0.315	13.026 ± 0.273	2.741	2.369	2.125	15.8
72.	53.345	1.8	0.135	24.574 ± 0.387	13.172 ± 0.332	2.829	2.428	2.211	15.4
78.	37.020	1.2	0.100	24.317 ± 0.458	13.378 ± 0.403	2.788	2.452	1.768	12.8
84.	26.463	0.9	0.074	24.123 ± 0.552	13.509 ± 0.476	2.839	2.450	0.943	6.7
90.	18.338	0.6	0.055	24.125 ± 0.551	13.600 ± 0.556	2.786	2.382	0.957	7.0
96.	13.250	0.4	0.041	24.191 ± 0.757	13.751 ± 0.648	2.756	2.358	0.859	6.5

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 1980 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	506.405	100.0	0.175	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	743.526	146.8	0.257	26.213 ± 0.007	13.624 ± 0.008	0.178	0.219	0.012	21.4
6.	938.273	185.3	0.324	26.254 ± 0.011	13.602 ± 0.014	0.351	0.421	0.047	21.1
9.	1089.655	215.2	0.377	26.290 ± 0.015	13.583 ± 0.019	0.521	0.611	0.104	20.9
12.	1202.946	237.5	0.417	26.319 ± 0.020	13.565 ± 0.022	0.689	0.779	0.185	21.3
18.	1324.997	261.6	0.469	26.336 ± 0.027	13.532 ± 0.029	0.993	1.047	0.399	22.0
24.	1323.106	261.3	0.479	26.309 ± 0.035	13.473 ± 0.034	1.268	1.226	0.642	21.8
30.	1237.549	244.4	0.465	26.257 ± 0.043	13.451 ± 0.038	1.498	1.339	0.864	21.0
36.	1102.615	217.7	0.438	26.226 ± 0.050	13.456 ± 0.043	1.672	1.412	1.014	19.9
42.	958.756	189.3	0.404	26.149 ± 0.057	13.400 ± 0.048	1.778	1.476	1.118	19.5
48.	847.440	167.3	0.379	26.123 ± 0.065	13.395 ± 0.054	1.934	1.576	1.360	20.0
54.	721.208	142.4	0.347	26.073 ± 0.075	13.384 ± 0.062	2.048	1.662	1.535	20.1
60.	605.907	119.6	0.315	26.017 ± 0.087	13.449 ± 0.070	2.139	1.722	1.567	18.9
66.	500.188	98.8	0.280	26.003 ± 0.100	13.505 ± 0.080	2.236	1.781	1.521	16.9
72.	395.799	78.2	0.238	26.015 ± 0.115	13.573 ± 0.094	2.292	1.876	1.560	16.5
78.	310.025	61.2	0.199	26.022 ± 0.135	13.610 ± 0.111	2.390	1.958	1.593	15.6
84.	241.985	47.8	0.167	25.992 ± 0.160	13.678 ± 0.127	2.493	1.981	1.639	14.8
90.	197.144	38.9	0.145	26.066 ± 0.178	13.672 ± 0.136	2.495	1.913	1.903	17.0
96.	162.523	32.1	0.126	26.173 ± 0.198	13.744 ± 0.146	2.528	1.862	1.871	16.3

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: JAN HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	141.029	100.0	0.191	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	169.805	120.4	0.230	26.249 ± 0.019	13.586 ± 0.025	0.247	0.327	-0.003	-2.8
6.	202.290	143.4	0.274	26.326 ± 0.032	13.520 ± 0.044	0.459	0.625	-0.025	-6.7
9.	225.591	160.0	0.309	26.382 ± 0.043	13.453 ± 0.058	0.644	0.871	-0.044	-6.1
12.	242.111	171.7	0.337	26.416 ± 0.053	13.394 ± 0.069	0.823	1.077	-0.052	-4.4
18.	250.795	177.8	0.377	26.425 ± 0.074	13.351 ± 0.098	1.172	1.394	0.035	1.5
24.	243.955	173.0	0.387	26.438 ± 0.095	13.234 ± 0.103	1.480	1.613	0.094	2.4
30.	221.506	157.1	0.374	26.418 ± 0.114	13.108 ± 0.122	1.696	1.817	0.104	2.1
36.	197.593	140.1	0.361	26.321 ± 0.137	12.905 ± 0.140	1.922	1.965	0.281	4.4
42.	173.759	123.2	0.338	26.123 ± 0.162	12.699 ± 0.160	2.129	2.114	0.536	6.7
48.	153.487	108.8	0.311	25.905 ± 0.190	12.519 ± 0.181	2.350	2.243	0.897	9.2
54.	134.334	95.3	0.290	25.686 ± 0.220	12.421 ± 0.198	2.545	2.192	1.144	10.0
60.	116.121	82.3	0.263	25.533 ± 0.255	12.431 ± 0.201	2.753	2.171	1.254	9.4
66.	92.291	65.4	0.222	25.080 ± 0.288	12.546 ± 0.229	2.770	2.196	1.338	9.9
72.	69.115	49.0	0.175	24.773 ± 0.353	12.727 ± 0.271	2.937	2.256	1.073	7.1
78.	52.826	37.5	0.143	24.435 ± 0.415	12.953 ± 0.318	3.015	2.312	0.932	5.9
84.	42.997	30.5	0.120	24.180 ± 0.482	13.176 ± 0.353	3.161	2.311	-0.233	-1.3
90.	33.448	23.7	0.100	24.347 ± 0.532	13.256 ± 0.375	3.076	2.166	0.156	0.9
96.	27.497	19.5	0.085	24.460 ± 0.581	13.655 ± 0.409	3.049	2.143	-0.184	-1.1

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: APR HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	720.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	720.	100.0	26.159 ± 0.008	13.641 ± 0.011	0.209	0.300	0.001	1.5
6.	720.	100.0	26.140 ± 0.015	13.644 ± 0.021	0.401	0.572	0.003	1.0
9.	720.	100.0	26.105 ± 0.022	13.653 ± 0.030	0.578	0.811	0.001	0.2
12.	720.	100.0	26.060 ± 0.028	13.664 ± 0.038	0.752	1.027	-0.008	-0.8
18.	715.	99.3	25.948 ± 0.040	13.671 ± 0.052	1.061	1.381	-0.041	-2.1
24.	703.	97.6	25.825 ± 0.050	13.681 ± 0.062	1.320	1.633	0.020	0.6
30.	695.	96.5	25.734 ± 0.058	13.652 ± 0.070	1.535	1.840	0.082	2.0
36.	683.	94.9	25.660 ± 0.067	13.618 ± 0.077	1.741	2.007	0.136	2.6
42.	667.	92.6	25.597 ± 0.074	13.607 ± 0.082	1.919	2.118	0.044	0.7
48.	638.	88.6	25.456 ± 0.081	13.632 ± 0.087	2.040	2.200	-0.021	-0.3
54.	603.	83.8	25.257 ± 0.087	13.670 ± 0.091	2.147	2.239	-0.103	-1.3
60.	566.	78.6	25.105 ± 0.094	13.718 ± 0.092	2.231	2.193	-0.252	-2.9
66.	538.	74.7	24.926 ± 0.099	13.799 ± 0.096	2.289	2.217	-0.389	-4.3
72.	512.	71.1	24.762 ± 0.104	13.900 ± 0.098	2.363	2.213	-0.398	-4.1
78.	491.	68.2	24.669 ± 0.110	13.991 ± 0.100	2.447	2.218	-0.392	-3.7
84.	468.	65.0	24.616 ± 0.118	14.137 ± 0.103	2.545	2.230	-0.501	-4.4
90.	445.	61.8	24.447 ± 0.118	14.286 ± 0.107	2.499	2.249	-0.496	-4.5
96.	431.	59.9	24.379 ± 0.122	14.455 ± 0.109	2.542	2.257	-0.784	-6.9

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: APR HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1834.524	100.0	2.548	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	1566.016	85.4	2.175	26.159 ± 0.005	13.632 ± 0.007	0.208	0.295	0.002	2.9
6.	1345.147	73.3	1.868	26.145 ± 0.011	13.613 ± 0.015	0.398	0.556	0.009	3.4
9.	1157.644	63.1	1.608	26.120 ± 0.017	13.589 ± 0.023	0.568	0.779	0.016	2.8
12.	993.268	54.1	1.380	26.091 ± 0.023	13.554 ± 0.031	0.732	0.976	0.020	2.1
18.	723.989	39.5	1.013	26.019 ± 0.038	13.451 ± 0.048	1.029	1.292	0.022	1.2
24.	524.041	28.6	0.745	25.925 ± 0.055	13.360 ± 0.065	1.287	1.493	0.094	3.2
30.	383.791	20.9	0.552	25.839 ± 0.075	13.254 ± 0.084	1.487	1.644	0.123	3.2
36.	282.441	15.4	0.414	25.772 ± 0.101	13.154 ± 0.105	1.705	1.760	0.121	2.4
42.	207.714	11.3	0.311	25.712 ± 0.131	13.077 ± 0.127	1.891	1.837	-0.026	-0.4
48.	150.642	8.2	0.236	25.561 ± 0.161	13.023 ± 0.155	1.980	1.901	-0.180	-2.6
54.	109.241	6.0	0.181	25.397 ± 0.199	12.989 ± 0.187	2.077	1.954	-0.263	-3.5
60.	77.697	4.2	0.137	25.295 ± 0.243	12.958 ± 0.216	2.140	1.905	-0.364	-4.5
66.	55.225	3.0	0.103	25.173 ± 0.293	12.950 ± 0.255	2.179	1.898	-0.689	-8.3
72.	39.297	2.1	0.077	25.058 ± 0.364	13.091 ± 0.305	2.284	1.910	-0.690	-7.5
78.	28.317	1.5	0.058	24.934 ± 0.445	13.224 ± 0.359	2.368	1.909	-1.012	-10.2
84.	19.877	1.1	0.042	24.805 ± 0.562	13.442 ± 0.439	2.505	1.957	-1.435	-12.9
90.	13.772	0.8	0.031	24.499 ± 0.562	13.619 ± 0.545	2.456	2.023	-1.557	-14.5
96.	10.015	0.5	0.023	24.405 ± 0.804	13.736 ± 0.671	2.544	2.122	-2.044	-17.5

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: APR HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	114.658	100.0	0.159	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	152.272	132.8	0.211	26.160 ± 0.016	13.613 ± 0.023	0.203	0.280	0.005	7.1
6.	185.143	161.5	0.257	26.149 ± 0.028	13.570 ± 0.039	0.382	0.527	0.016	6.5
9.	207.264	180.8	0.288	26.143 ± 0.037	13.505 ± 0.051	0.538	0.733	0.027	5.4
12.	219.993	191.9	0.306	26.134 ± 0.047	13.408 ± 0.061	0.695	0.898	0.046	5.4
18.	226.458	197.5	0.317	26.085 ± 0.065	13.147 ± 0.073	0.992	1.105	0.067	3.9
24.	215.724	188.1	0.307	26.020 ± 0.084	12.926 ± 0.083	1.230	1.221	0.153	5.8
30.	201.304	175.6	0.290	25.950 ± 0.100	12.741 ± 0.093	1.412	1.316	0.204	5.8
36.	184.506	160.9	0.270	25.904 ± 0.122	12.581 ± 0.102	1.653	1.389	0.236	4.9
42.	168.726	147.2	0.253	25.876 ± 0.142	12.456 ± 0.109	1.839	1.420	0.220	3.7
48.	152.739	133.2	0.239	25.755 ± 0.153	12.341 ± 0.114	1.887	1.409	0.079	1.3
54.	133.885	116.8	0.222	25.602 ± 0.170	12.286 ± 0.124	1.972	1.453	-0.020	-0.3
60.	114.374	99.8	0.202	25.617 ± 0.187	12.259 ± 0.133	1.998	1.421	-0.031	-0.4
66.	94.393	82.3	0.175	25.427 ± 0.212	12.292 ± 0.156	2.056	1.520	-0.510	-6.9
72.	78.251	68.2	0.153	25.705 ± 0.248	12.557 ± 0.193	2.196	1.703	-0.329	-3.9
78.	62.670	54.7	0.128	25.582 ± 0.289	12.595 ± 0.203	2.286	1.608	-1.367	-14.7
84.	48.203	42.0	0.103	25.545 ± 0.357	12.710 ± 0.239	2.476	1.658	-2.225	-20.0
90.	34.763	30.3	0.078	25.328 ± 0.424	12.887 ± 0.293	2.501	1.727	-2.478	-21.6
96.	28.368	24.7	0.066	25.427 ± 0.503	12.919 ± 0.347	2.678	1.847	-3.023	-22.8

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: JUL HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	744.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	744.	100.0	26.222 ± 0.005	13.644 ± 0.004	0.124	0.122	0.007	23.3
6.	744.	100.0	26.284 ± 0.009	13.643 ± 0.009	0.253	0.237	0.027	23.2
9.	744.	100.0	26.348 ± 0.014	13.649 ± 0.013	0.385	0.346	0.063	23.1
12.	744.	100.0	26.413 ± 0.019	13.661 ± 0.016	0.519	0.448	0.114	23.0
18.	744.	100.0	26.548 ± 0.029	13.703 ± 0.023	0.785	0.632	0.254	22.4
24.	744.	100.0	26.697 ± 0.039	13.769 ± 0.030	1.054	0.806	0.440	21.6
30.	739.	99.3	26.856 ± 0.049	13.868 ± 0.036	1.323	0.976	0.679	21.2
36.	718.	96.5	26.955 ± 0.056	13.966 ± 0.042	1.507	1.112	0.843	20.4
42.	690.	92.7	27.045 ± 0.064	14.100 ± 0.046	1.684	1.215	1.030	20.0
48.	673.	90.5	27.157 ± 0.071	14.220 ± 0.052	1.852	1.354	1.226	19.7
54.	651.	87.5	27.297 ± 0.080	14.406 ± 0.056	2.047	1.431	1.499	19.7
60.	633.	85.1	27.423 ± 0.088	14.549 ± 0.060	2.213	1.517	1.740	19.6
66.	607.	81.6	27.508 ± 0.095	14.696 ± 0.066	2.337	1.624	1.969	19.8
72.	562.	75.5	27.485 ± 0.103	14.787 ± 0.070	2.438	1.668	2.025	18.8
78.	532.	71.5	27.575 ± 0.109	14.962 ± 0.077	2.519	1.771	2.208	19.2
84.	489.	65.7	27.553 ± 0.115	15.121 ± 0.083	2.539	1.845	2.319	19.8
90.	458.	61.6	27.537 ± 0.120	15.263 ± 0.090	2.573	1.924	2.436	20.2
96.	434.	58.3	27.567 ± 0.123	15.419 ± 0.097	2.573	2.018	2.569	21.2

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: JUL HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1484.945	100.0	1.996	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	1242.430	83.7	1.670	26.221 ± 0.004	13.642 ± 0.003	0.123	0.121	0.007	24.4
6.	1045.669	70.4	1.405	26.281 ± 0.008	13.639 ± 0.007	0.251	0.236	0.029	24.6
9.	883.510	59.5	1.188	26.342 ± 0.013	13.641 ± 0.012	0.382	0.344	0.067	24.5
12.	747.529	50.3	1.005	26.404 ± 0.019	13.651 ± 0.016	0.514	0.444	0.120	24.4
18.	537.505	36.2	0.722	26.537 ± 0.034	13.689 ± 0.027	0.780	0.622	0.266	23.6
24.	385.646	26.0	0.518	26.675 ± 0.053	13.744 ± 0.040	1.040	0.780	0.440	22.1
30.	274.951	18.5	0.372	26.817 ± 0.078	13.824 ± 0.056	1.288	0.922	0.622	20.5
36.	193.839	13.1	0.270	26.937 ± 0.107	13.918 ± 0.075	1.493	1.042	0.781	19.3
42.	134.086	9.0	0.194	27.045 ± 0.144	14.026 ± 0.098	1.671	1.132	0.948	18.8
48.	93.785	6.3	0.139	27.190 ± 0.191	14.116 ± 0.130	1.851	1.261	1.150	18.6
54.	64.767	4.4	0.099	27.356 ± 0.257	14.267 ± 0.165	2.067	1.327	1.457	18.8
60.	44.737	3.0	0.071	27.510 ± 0.335	14.382 ± 0.207	2.249	1.387	1.718	18.8
66.	30.186	2.0	0.050	27.611 ± 0.430	14.495 ± 0.265	2.360	1.458	1.890	18.7
72.	19.796	1.3	0.035	27.623 ± 0.557	14.577 ± 0.343	2.477	1.527	2.027	18.3
78.	13.091	0.9	0.025	27.702 ± 0.720	14.714 ± 0.453	2.607	1.638	2.302	18.7
84.	8.232	0.6	0.017	27.598 ± 0.926	14.796 ± 0.601	2.656	1.724	2.396	18.8
90.	5.317	0.4	0.012	27.546 ± 1.184	14.889 ± 0.784	2.729	1.807	2.541	18.8
96.	3.466	0.2	0.008	27.530 ± 1.509	14.977 ± 1.023	2.810	1.904	2.776	19.4

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: JUL HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	142.176	100.0	0.191	26.150 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	235.124	165.4	0.316	26.218 ± 0.008	13.638 ± 0.008	0.121	0.120	0.007	26.8
6.	309.673	217.8	0.416	26.272 ± 0.014	13.630 ± 0.013	0.246	0.232	0.030	26.6
9.	367.542	258.5	0.494	26.330 ± 0.020	13.632 ± 0.018	0.376	0.338	0.069	25.9
12.	412.902	290.4	0.555	26.391 ± 0.025	13.644 ± 0.021	0.507	0.436	0.123	25.5
18.	474.355	333.6	0.638	26.526 ± 0.035	13.679 ± 0.028	0.774	0.603	0.263	23.8
24.	496.149	349.0	0.667	26.643 ± 0.045	13.713 ± 0.033	1.013	0.732	0.391	20.9
30.	494.955	348.1	0.670	26.785 ± 0.056	13.789 ± 0.038	1.244	0.846	0.511	18.3
36.	479.345	337.1	0.668	26.917 ± 0.067	13.879 ± 0.043	1.467	0.943	0.646	16.7
42.	435.082	306.0	0.631	27.043 ± 0.079	13.947 ± 0.049	1.642	1.022	0.787	16.3
48.	392.526	276.1	0.583	27.207 ± 0.094	13.982 ± 0.056	1.861	1.106	0.971	15.7
54.	351.573	247.3	0.540	27.409 ± 0.112	14.096 ± 0.062	2.098	1.157	1.257	15.9
60.	313.165	220.3	0.495	27.642 ± 0.127	14.239 ± 0.067	2.250	1.180	1.453	16.0
66.	270.541	190.3	0.446	27.798 ± 0.142	14.381 ± 0.075	2.336	1.238	1.577	16.1
72.	228.630	160.8	0.407	27.847 ± 0.163	14.470 ± 0.089	2.467	1.346	1.800	16.5
78.	187.747	132.1	0.353	27.961 ± 0.194	14.558 ± 0.106	2.654	1.453	2.183	17.2
84.	142.067	99.9	0.291	27.841 ± 0.229	14.586 ± 0.129	2.712	1.538	2.177	16.5
90.	114.456	80.5	0.250	27.778 ± 0.264	14.629 ± 0.150	2.823	1.610	2.322	16.2
96.	92.969	65.4	0.214	27.785 ± 0.309	14.675 ± 0.179	2.984	1.722	2.696	16.8

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: OCT HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	744.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	744.	100.0	26.279 ± 0.007	13.673 ± 0.008	0.184	0.205	0.004	6.8
6.	744.	100.0	26.395 ± 0.014	13.708 ± 0.015	0.371	0.408	0.018	7.4
9.	743.	99.9	26.502 ± 0.020	13.755 ± 0.022	0.541	0.610	0.046	8.9
12.	740.	99.5	26.595 ± 0.026	13.818 ± 0.029	0.697	0.802	0.102	11.9
18.	725.	97.4	26.733 ± 0.035	13.978 ± 0.044	0.963	1.177	0.278	16.7
24.	708.	95.2	26.836 ± 0.046	14.162 ± 0.058	1.215	1.533	0.499	18.7
30.	684.	91.9	26.883 ± 0.055	14.358 ± 0.071	1.429	1.855	0.765	20.5
36.	659.	88.6	26.849 ± 0.062	14.486 ± 0.083	1.596	2.121	1.026	21.9
42.	621.	83.5	26.844 ± 0.070	14.518 ± 0.090	1.733	2.255	1.185	21.5
48.	582.	78.2	26.750 ± 0.075	14.538 ± 0.097	1.799	2.351	1.187	20.1
54.	541.	72.7	26.662 ± 0.079	14.521 ± 0.102	1.829	2.382	0.870	14.6
60.	510.	68.5	26.629 ± 0.085	14.529 ± 0.105	1.910	2.380	0.639	9.9
66.	477.	64.1	26.484 ± 0.087	14.425 ± 0.109	1.891	2.376	0.520	8.3
72.	454.	61.0	26.446 ± 0.089	14.361 ± 0.109	1.900	2.320	0.507	8.0
78.	435.	58.5	26.454 ± 0.091	14.334 ± 0.110	1.906	2.294	0.633	9.9
84.	423.	56.9	26.456 ± 0.095	14.279 ± 0.113	1.945	2.321	0.884	13.2
90.	399.	53.6	26.352 ± 0.096	14.205 ± 0.118	1.926	2.357	1.030	15.5
96.	381.	51.2	26.387 ± 0.101	14.250 ± 0.120	1.969	2.346	1.114	16.0

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: OCT HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	1895.675	100.0	2.548	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	1640.552	86.5	2.205	26.281 ± 0.005	13.674 ± 0.005	0.184	0.203	0.004	6.4
6.	1429.799	75.4	1.922	26.400 ± 0.010	13.711 ± 0.011	0.368	0.404	0.016	6.6
9.	1252.675	66.1	1.686	26.509 ± 0.015	13.760 ± 0.017	0.537	0.606	0.038	7.6
12.	1098.057	57.9	1.484	26.604 ± 0.021	13.824 ± 0.024	0.688	0.797	0.083	9.9
18.	833.888	44.0	1.150	26.747 ± 0.033	13.972 ± 0.040	0.956	1.162	0.206	12.7
24.	621.166	32.8	0.877	26.846 ± 0.048	14.122 ± 0.060	1.207	1.492	0.375	14.4
30.	459.430	24.2	0.672	26.918 ± 0.065	14.247 ± 0.084	1.424	1.795	0.630	17.1
36.	334.521	17.6	0.508	26.962 ± 0.087	14.275 ± 0.111	1.596	2.030	0.936	20.2
42.	237.686	12.5	0.383	26.937 ± 0.112	14.215 ± 0.140	1.721	2.154	1.138	21.0
48.	168.586	8.9	0.290	26.895 ± 0.141	14.104 ± 0.169	1.829	2.195	1.250	20.5
54.	120.409	6.4	0.223	26.876 ± 0.173	13.910 ± 0.194	1.898	2.127	1.183	18.2
60.	88.345	4.7	0.173	26.887 ± 0.213	13.797 ± 0.226	1.998	2.126	1.366	18.9
66.	62.751	3.3	0.132	26.709 ± 0.247	13.562 ± 0.252	1.955	2.074	1.317	19.0
72.	45.736	2.4	0.101	26.612 ± 0.289	13.413 ± 0.302	1.955	2.042	1.360	19.6
78.	33.649	1.8	0.077	26.576 ± 0.337	13.346 ± 0.348	1.958	2.019	1.438	20.6
84.	25.149	1.3	0.059	26.531 ± 0.401	13.296 ± 0.404	2.010	2.028	1.606	21.7
90.	18.100	1.0	0.045	26.315 ± 0.454	13.188 ± 0.467	1.950	1.988	1.520	21.8
96.	13.592	0.7	0.036	26.311 ± 0.539	13.288 ± 0.536	1.985	1.976	1.550	21.5

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: OCT HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	118.480	100.0	0.159	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	164.425	138.8	0.221	26.282 ± 0.014	13.678 ± 0.015	0.182	0.198	0.004	4.3
6.	206.773	174.5	0.278	26.396 ± 0.026	13.720 ± 0.028	0.370	0.397	0.014	5.9
9.	242.650	204.8	0.327	26.500 ± 0.035	13.766 ± 0.038	0.538	0.597	0.030	5.8
12.	269.696	227.6	0.364	26.590 ± 0.042	13.819 ± 0.048	0.692	0.786	0.058	6.9
18.	297.221	250.9	0.410	26.727 ± 0.056	13.919 ± 0.054	0.969	1.133	0.130	7.9
24.	287.177	242.4	0.406	26.843 ± 0.072	13.976 ± 0.084	1.217	1.431	0.322	12.3
30.	265.477	224.1	0.388	26.992 ± 0.089	13.987 ± 0.104	1.456	1.693	0.739	19.2
36.	236.002	199.2	0.358	27.141 ± 0.107	13.900 ± 0.124	1.647	1.904	1.294	25.5
42.	205.763	173.7	0.331	27.103 ± 0.122	13.755 ± 0.141	1.756	2.022	1.529	26.4
48.	177.424	149.8	0.305	27.082 ± 0.142	13.555 ± 0.157	1.889	2.028	1.783	26.5
54.	159.381	134.5	0.295	27.119 ± 0.160	13.376 ± 0.156	2.018	1.975	2.087	27.1
60.	144.907	122.3	0.284	27.084 ± 0.175	13.287 ± 0.168	2.119	2.022	2.296	27.1
66.	121.623	102.7	0.255	26.727 ± 0.189	12.964 ± 0.173	2.075	1.908	1.876	23.5
72.	105.187	88.8	0.232	26.533 ± 0.201	12.719 ± 0.166	2.060	1.702	1.667	21.4
78.	95.850	80.9	0.220	26.421 ± 0.212	12.710 ± 0.169	2.074	1.654	1.624	20.7
84.	87.497	73.8	0.207	26.305 ± 0.222	12.752 ± 0.170	2.074	1.592	1.452	18.7
90.	77.670	65.6	0.195	26.024 ± 0.215	12.710 ± 0.162	1.908	1.429	1.032	15.8
96.	73.153	61.7	0.192	26.050 ± 0.221	12.826 ± 0.167	1.887	1.425	1.009	15.8

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7801 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	xSIGMA	YSIGMA	COVARIANCE	THETA
0.	246.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	246.	100.0	26.257 ± 0.021	13.551 ± 0.018	0.323	0.278	-0.024	-12.9
6.	246.	100.0	26.354 ± 0.039	13.458 ± 0.034	0.618	0.530	-0.063	-9.3
9.	246.	100.0	26.443 ± 0.054	13.362 ± 0.049	0.879	0.767	-0.085	-6.2
12.	246.	100.0	26.523 ± 0.071	13.263 ± 0.063	1.107	0.990	-0.080	-3.7
18.	242.	98.4	26.642 ± 0.096	13.091 ± 0.088	1.497	1.374	-0.018	-0.4
24.	239.	97.2	26.703 ± 0.119	12.927 ± 0.109	1.836	1.684	0.108	1.8
30.	234.	95.1	26.691 ± 0.141	12.767 ± 0.127	2.159	1.940	0.389	4.8
36.	227.	92.3	26.557 ± 0.159	12.533 ± 0.140	2.403	2.111	0.643	6.4
42.	221.	89.8	26.391 ± 0.180	12.327 ± 0.152	2.673	2.259	1.226	9.7
48.	215.	87.4	26.195 ± 0.200	12.235 ± 0.165	2.939	2.416	2.085	13.6
54.	202.	82.1	25.923 ± 0.220	12.281 ± 0.172	3.125	2.447	2.779	15.9
60.	198.	80.5	25.747 ± 0.241	12.352 ± 0.179	3.385	2.520	3.528	17.1
66.	187.	76.0	25.220 ± 0.251	12.382 ± 0.186	3.439	2.543	3.977	18.6
72.	181.	73.6	24.905 ± 0.262	12.469 ± 0.194	3.519	2.615	4.431	19.7
78.	166.	67.5	24.514 ± 0.268	12.839 ± 0.196	3.459	2.530	4.541	20.8
84.	162.	65.9	24.205 ± 0.265	12.983 ± 0.201	3.377	2.555	3.411	16.7
90.	156.	63.4	23.877 ± 0.256	13.159 ± 0.211	3.193	2.640	2.364	13.1
96.	153.	62.2	23.676 ± 0.253	13.341 ± 0.222	3.132	2.745	1.624	9.4

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7801 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	xSIGMA	YSIGMA	COVARIANCE	THETA
0.	1013.320	100.0	4.119	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	854.259	84.3	3.473	26.265 ± 0.011	13.551 ± 0.009	0.319	0.275	-0.024	-13.3
6.	732.394	72.3	2.977	26.376 ± 0.022	13.458 ± 0.019	0.604	0.521	-0.064	-9.9
9.	632.290	62.4	2.570	26.479 ± 0.034	13.359 ± 0.030	0.855	0.751	-0.088	-6.8
12.	547.926	54.1	2.227	26.575 ± 0.046	13.253 ± 0.041	1.081	0.968	-0.083	-4.1
18.	407.576	40.2	1.684	26.709 ± 0.073	13.067 ± 0.066	1.477	1.341	-0.015	-0.4
24.	304.962	30.1	1.276	26.768 ± 0.104	12.882 ± 0.094	1.823	1.650	0.126	2.2
30.	224.969	22.2	0.961	26.736 ± 0.142	12.695 ± 0.127	2.126	1.910	0.355	4.5
36.	165.180	16.3	0.728	26.621 ± 0.183	12.469 ± 0.163	2.349	2.097	0.568	5.9
42.	120.630	11.9	0.546	26.449 ± 0.235	12.259 ± 0.205	2.576	2.247	1.028	8.8
48.	87.800	8.7	0.408	26.253 ± 0.304	12.132 ± 0.255	2.845	2.385	1.750	12.2
54.	61.868	6.1	0.306	25.993 ± 0.394	12.154 ± 0.300	3.098	2.362	2.274	13.3
60.	45.168	4.5	0.228	25.789 ± 0.499	12.204 ± 0.351	3.351	2.359	2.752	13.8
66.	31.749	3.1	0.170	25.250 ± 0.597	12.307 ± 0.411	3.365	2.316	3.121	15.4
72.	22.827	2.3	0.126	24.949 ± 0.717	12.470 ± 0.490	3.425	2.340	3.417	16.2
78.	15.490	1.5	0.093	24.612 ± 0.852	12.788 ± 0.577	3.353	2.271	3.427	16.9
84.	11.089	1.1	0.068	24.409 ± 1.008	12.924 ± 0.703	3.356	2.340	2.643	13.2
90.	7.901	0.8	0.051	24.262 ± 1.166	13.059 ± 0.863	3.277	2.426	2.119	11.2
96.	5.699	0.6	0.037	24.168 ± 1.332	13.244 ± 1.050	3.180	2.507	1.539	8.7

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7901 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	47.010	100.0	0.191	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	53.230	113.2	0.216	26.295 ± 0.040	13.547 ± 0.036	0.294	0.265	-0.024	-15.3
6.	63.311	134.7	0.257	26.441 ± 0.069	13.445 ± 0.063	0.537	0.504	-0.072	-14.0
9.	71.703	152.5	0.291	26.582 ± 0.089	13.317 ± 0.085	0.749	0.716	-0.108	-10.9
12.	79.461	169.0	0.323	26.712 ± 0.109	13.188 ± 0.102	0.959	0.909	-0.116	-7.2
18.	89.050	189.4	0.368	26.918 ± 0.142	12.946 ± 0.131	1.344	1.237	-0.015	-0.5
24.	92.059	195.8	0.385	27.080 ± 0.173	12.690 ± 0.156	1.665	1.500	0.252	5.2
30.	89.727	190.9	0.383	27.150 ± 0.200	12.431 ± 0.183	1.895	1.736	0.528	8.4
36.	85.091	181.0	0.375	27.190 ± 0.225	12.202 ± 0.211	2.077	1.944	0.882	11.6
42.	77.614	165.1	0.351	27.055 ± 0.263	11.959 ± 0.239	2.320	2.106	1.226	12.8
48.	68.300	145.3	0.318	26.875 ± 0.322	11.765 ± 0.272	2.661	2.251	1.673	13.3
54.	58.547	124.5	0.290	26.693 ± 0.390	11.795 ± 0.294	2.984	2.246	1.799	11.4
60.	51.843	110.3	0.262	26.571 ± 0.450	11.896 ± 0.307	3.240	2.209	1.756	9.5
66.	40.798	86.8	0.218	25.992 ± 0.512	12.127 ± 0.340	3.270	2.173	1.838	9.8
72.	31.630	67.3	0.175	25.890 ± 0.600	12.378 ± 0.386	3.372	2.171	2.076	10.3
78.	23.940	50.9	0.144	25.655 ± 0.702	12.752 ± 0.417	3.432	2.042	3.276	15.5
84.	19.075	40.6	0.118	25.525 ± 0.814	12.727 ± 0.456	3.557	1.989	2.719	12.1
90.	15.165	32.3	0.097	25.467 ± 0.906	12.756 ± 0.499	3.529	1.942	2.471	11.2
96.	12.911	27.5	0.084	25.452 ± 0.928	12.966 ± 0.534	3.335	1.920	1.774	9.1

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7807 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	248.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	248.	100.0	26.210 ± 0.009	13.660 ± 0.007	0.135	0.118	0.007	20.4
6.	248.	100.0	26.263 ± 0.017	13.675 ± 0.015	0.273	0.230	0.027	20.1
9.	248.	100.0	26.319 ± 0.026	13.696 ± 0.021	0.412	0.336	0.061	19.7
12.	248.	100.0	26.377 ± 0.035	13.722 ± 0.028	0.549	0.434	0.105	19.2
18.	248.	100.0	26.502 ± 0.051	13.787 ± 0.038	0.809	0.603	0.211	17.9
24.	248.	100.0	26.644 ± 0.067	13.872 ± 0.047	1.054	0.744	0.323	16.2
30.	248.	100.0	26.810 ± 0.081	13.979 ± 0.055	1.281	0.866	0.424	14.5
36.	248.	100.0	27.001 ± 0.094	14.108 ± 0.062	1.487	0.980	0.513	13.0
42.	248.	100.0	27.213 ± 0.106	14.260 ± 0.070	1.669	1.098	0.605	12.3
48.	248.	100.0	27.440 ± 0.116	14.435 ± 0.078	1.820	1.226	0.714	12.2
54.	248.	100.0	27.677 ± 0.123	14.632 ± 0.087	1.942	1.363	0.847	12.7
60.	247.	99.6	27.899 ± 0.129	14.846 ± 0.096	2.024	1.502	1.021	14.0
66.	242.	97.6	28.044 ± 0.130	15.072 ± 0.106	2.028	1.647	1.241	16.8
72.	236.	95.2	28.182 ± 0.132	15.215 ± 0.108	2.033	1.653	1.224	16.5
78.	233.	94.0	28.351 ± 0.134	15.424 ± 0.114	2.052	1.734	1.396	18.3
84.	219.	88.3	28.343 ± 0.134	15.555 ± 0.122	1.978	1.810	1.402	19.7
90.	210.	84.7	28.399 ± 0.134	15.730 ± 0.129	1.943	1.872	1.489	21.5
96.	202.	81.5	28.454 ± 0.134	15.946 ± 0.137	1.902	1.954	1.617	24.1

SOURCE STATION IS: 28 - PEN CONMJO ALLEG PERIOD: 7807 HEIGHT: SFC SULPHUR DIOXIDE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	494.982	100.0	1.996	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	416.711	84.2	1.680	26.212 ± 0.007	13.658 ± 0.006	0.134	0.117	0.007	22.0
6.	353.212	71.4	1.424	26.269 ± 0.014	13.671 ± 0.012	0.271	0.228	0.030	22.0
9.	299.903	60.6	1.209	26.328 ± 0.024	13.691 ± 0.019	0.409	0.332	0.065	21.4
12.	254.688	51.5	1.027	26.392 ± 0.034	13.718 ± 0.027	0.545	0.427	0.112	20.7
18.	184.102	37.2	0.742	26.535 ± 0.059	13.792 ± 0.043	0.805	0.590	0.227	19.3
24.	132.849	26.8	0.536	26.699 ± 0.091	13.887 ± 0.063	1.050	0.721	0.343	17.2
30.	95.923	19.4	0.387	26.895 ± 0.131	14.010 ± 0.085	1.283	0.831	0.436	14.8
36.	69.518	14.0	0.280	27.123 ± 0.179	14.152 ± 0.112	1.490	0.931	0.488	12.4
42.	50.338	10.2	0.203	27.370 ± 0.235	14.306 ± 0.144	1.670	1.025	0.520	10.6
48.	36.106	7.3	0.146	27.630 ± 0.303	14.460 ± 0.185	1.820	1.111	0.536	9.2
54.	25.754	5.2	0.104	27.914 ± 0.383	14.615 ± 0.235	1.943	1.195	0.566	8.5
60.	18.259	3.7	0.074	28.175 ± 0.475	14.778 ± 0.299	2.030	1.279	0.631	8.7
66.	12.528	2.5	0.052	28.319 ± 0.577	14.948 ± 0.390	2.041	1.382	0.753	10.3
72.	8.640	1.7	0.037	28.503 ± 0.708	15.106 ± 0.497	2.082	1.462	0.870	11.4
78.	5.910	1.2	0.025	28.696 ± 0.875	15.272 ± 0.642	2.128	1.561	1.056	13.1
84.	3.705	0.7	0.017	28.618 ± 1.079	15.292 ± 0.859	2.075	1.653	0.948	12.4
90.	2.416	0.5	0.012	28.681 ± 1.335	15.376 ± 1.112	2.075	1.729	1.018	13.3
96.	1.593	0.3	0.008	28.757 ± 1.537	15.467 ± 1.431	2.065	1.806	1.115	14.6

SOURCE STATION IS: 28 - PEN COMMJO ALLEG PERIOD: 7907 HEIGHT: SFC SULPHATE WEIGHTED

TIME	WEIGHT	% REMAINING	MEAN CONC.	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	47.392	100.0	0.191	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	80.455	169.8	0.324	26.216 ± 0.015	13.654 ± 0.013	0.132	0.115	0.008	25.5
6.	107.385	226.6	0.433	26.278 ± 0.026	13.670 ± 0.021	0.247	0.223	0.033	24.5
9.	127.544	269.1	0.514	26.342 ± 0.036	13.696 ± 0.028	0.404	0.321	0.068	22.5
12.	143.066	301.9	0.577	26.416 ± 0.045	13.730 ± 0.034	0.539	0.412	0.114	21.4
18.	164.128	346.3	0.662	26.582 ± 0.062	13.806 ± 0.044	0.798	0.559	0.224	19.4
24.	173.734	366.6	0.701	26.779 ± 0.079	13.901 ± 0.051	1.047	0.678	0.334	17.0
30.	176.237	371.9	0.711	27.016 ± 0.097	14.034 ± 0.058	1.282	0.773	0.402	13.7
36.	175.258	369.8	0.707	27.283 ± 0.112	14.157 ± 0.063	1.491	0.840	0.384	9.9
42.	165.758	349.8	0.668	27.555 ± 0.130	14.274 ± 0.067	1.671	0.864	0.318	6.5
48.	148.217	312.7	0.598	27.899 ± 0.150	14.352 ± 0.070	1.829	0.949	0.230	3.9
54.	139.195	293.7	0.561	28.259 ± 0.165	14.497 ± 0.076	1.947	0.900	0.226	3.4
60.	131.052	276.5	0.531	28.587 ± 0.177	14.688 ± 0.088	2.032	1.009	0.289	4.0
66.	110.862	233.9	0.458	28.780 ± 0.195	14.880 ± 0.110	2.055	1.153	0.384	5.2
72.	96.512	203.6	0.409	29.041 ± 0.210	15.029 ± 0.132	2.059	1.298	0.480	6.5
78.	78.728	166.1	0.338	29.409 ± 0.230	15.122 ± 0.161	2.037	1.430	0.678	9.3
84.	58.226	122.9	0.266	29.330 ± 0.254	14.990 ± 0.202	1.941	1.544	0.340	5.2
90.	46.606	98.3	0.222	29.432 ± 0.277	14.952 ± 0.234	1.893	1.599	0.310	4.9
96.	40.686	85.9	0.201	29.561 ± 0.285	15.048 ± 0.268	1.827	1.707	0.383	6.5

Concord Scientific Corporation

CALCULATION OF PUFF STATISTICS FROM ENSEMBLES OF INDIVIDUAL TRAJECTORIES:

ADDENDUM TO THE FINAL REPORT

CSC 110.J271.02aWP

Prepared for

THE ONTARIO MINISTRY OF THE ENVIRONMENT

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ADDENDUM

Examination of the OME Trajectory Model
and 1982 Trajectory Statistics

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1. INTRODUCTION

This ADDENDUM to the Final Report documents the work which was done as a result of some of the findings on the trajectory statistics for 1978-80. Those trajectories were generated using the OME Trajectory Model based on wind fields derived from surface pressure data. The means of the trajectory end-points for some of the months in 1978-80 suggested rather unexpected movement patterns. For this reason, the Ministry decided that parts of the code should be examined for possible inconsistencies, and also that comparisons should be made between surface and 850 mb trajectories. Due to data availability, the months of January and July of 1982 were chosen for which the trajectories and their statistics would be generated. This ADDENDUM documents this work in detail.

2. EXAMINATION OF THE ONTARIO MINISTRY OF THE ENVIRONMENT LAGRANGIAN LONG RANGE TRAJECTORY MODEL

The examination of the Long Range Lagrangian Trajectory Model developed by the Air Resources Branch of the Ontario Ministry of the Environment was restricted to the FORTRAN Source Code responsible for calculating the trajectories. This segment of the code is comprised of the following subroutines:

TRAJ,
NEWXY,
VELO,
and CMCLL.

The purpose of the subroutine TRAJ is to calculate the trajectories. The program processing logic is straightforward. The subroutine makes extensive use of do-loops to process more than one trajectory at a time. To simplify the following discussion, the generation of only one trajectory will be discussed.

Although the OME-modified CMC polar stereographic coordinate system is used to specify the location of source points and surface pressure data, it is not used internally in the Lagrangian Trajectory Model. Instead, these locations are transformed to corresponding locations on a square of unit length on each side. This unit square is

further subdivided into smaller squares. This square grid is used in the model because it avoids potential problems with the orthogonal polynomial scheme that is used to model the surface pressure field. These problems, which were discussed in Sykes and Hatton (1976), and Polavarpu (1980), are:

1) domain difficulties because polynomials tend to increase or decrease without bound as the coordinates increase, and
2) locally inaccurate fit resulting from sparse data near the boundaries.

As well, to reduce the effect of the latter problem, the grid is increased by 5% on all sides. The region of the polar stereographic grid that is mapped into the square grid depends on the availability of surface pressure and can change from time to time. The extremities of the locations of the data determine the region of the polar stereographic grid that is mapped into the square. The largest and smallest x-coordinates and the largest and smallest y-coordinates of the available locations of surface pressure data determine the rectangular region in the polar stereographic grid that is mapped into the square grid whose coordinates range in value from zero to one.

The process of generating the next point in the trajectory begins with the calculation of the surface geostrophic wind vector $\vec{u}_o$,

from the surface pressure field, at the latest point $\vec{p}_o$ in the trajectory. This wind is used to calculate a "first-guess" position for the new point $^{1}\vec{p}_1 = \vec{p}_o + \vec{u}_o\Delta t$, where the superscript indicates the guess number or iteration number. If the first-guess position falls outside of the normalized grid then the trajectory stops at the latest point and no further processing for the trajectory will occur. If, however, the first-guess position falls within the grid, then a surface geostrophic wind $\vec{u}_1$ is calculated for this new point. A second-guess for the next point in the trajectory is calculated assuming constant acceleration between the initial and the first-guess points:

$$^{2}\vec{p}_1 = \vec{p}_o + \left(\frac{\vec{u}_o + {}^{1}\vec{u}_1}{2}\right)\Delta t$$

Once again, the new point $^{2}\vec{p}_1$ is examined as to whether it lies within the grid. If it does not, then processing of the trajectory is stopped. Otherwise, processing continues and the convergence criterion is checked. Let the components of the position $^{k}\vec{p}_1$ be written as:

$$^{k}\vec{p}_1 = {}^{k}x_1\vec{i} + {}^{k}y_1\vec{j}$$

If $$|{}^{2}x_1 - {}^{1}x_1| < C$$

and

$$|{}^{2}y_1 - {}^{1}y_1| < C$$

then processing stops and $^{2}\vec{x}_1$ is the new endpoint. If not then the iterative process begins and $^{3}\vec{p}_1$ is calculated as follows:

$$^{3}\vec{p}_1 = \vec{p}_o + \left(\frac{^{2}\vec{u}_1 + \vec{u}_o}{2} \right) \Delta t \quad .$$

In general, for $k > 2$,

$$^{k}\vec{p}_1 = \vec{p}_o + \left(\frac{^{(k-1)}\vec{u}_1 + \vec{u}_o}{2} \right) \Delta t \quad .$$

Each time $^{k}\vec{p}_1$ is calculated, it is checked to determine whether it lies within the grid. If it does then the convergence criterion is tested, that is, if

$$|^{k}x_1 - {}^{(k-1)}x_1| < C$$

and

$$|^{k}y_1 - {}^{(k-1)}y_1| < C$$

then the iterative process stops and $^{k}\vec{p}_1$ is the new point in the trajectory. To prevent excessive and futile computation the number of iterations is restricted so that $k < k_{max}$. If a solution is not found within k_{max-1} iterations (remember $^{1}\vec{p}_1$ - the first guess position is not calculated in the iterative procedure since $^{1}\vec{p}_1 = \vec{p}_o + \vec{u}_o \Delta t$), then the trajectory ends at the previous endpoint and therefore doesn't survive for the full expected life-time. It has been determined by B. Ley and

G. Ellenton of OME that requiring convergence within 8 iterations (k_{max} = 9) and setting C = 0.001 works quite well. The value of C is in distance units of the square grid and is approximately equal to 0.381 km on the earth's surface.

The subroutine NEWXY is written to find the candidate next trajectory point. In a straightforward way it accepts the wind speed and direction from which it determines the x and y wind velocity components, multiplies these components by time and then adds them to the appropriate components of the last trajectory point and thereby creates the new point.

The purpose of the subroutine VELO is to calculate the surface geostrophic wind at a point and calculate a mean wind velocity by averaging the wind velocities of the point and a previous point. The subroutine also contains code to back wind direction and alter wind speed but this is no longer used. It is recommended that it be deleted entirely from the code. It would also be advisable to remove the section of code that calculates the mean wind velocity and set it up in another separate subroutine.

The equations used in VELO to calculate the surface geostrophic wind are developed as follows. Start with the equation for the geostrophic wind:

$$\vec{v}_s = \vec{k} \times \frac{1}{\rho f} \vec{\nabla}_s p \quad .$$

The subscript s serves to indicate that the coordinate system resides on the surface of the earth. The variable p is the surface pressure, ρ the density of air at the surface, and f is the Coriolis parameter. The unit vector $\vec{k}$ is taken to point in the upward direction. A thorough derivation of the geostrophic wind equation (pressure-gradient form) is given in Holton (1979).

To transform the equation into the polar stereographic coordinate system note that:

$$d = m d_s$$

where d_s is the true earth distance and d is the corresponding distance in the polar stereographic coordinate system. The map factor m is given by

$$m = \frac{1 + \sin \phi_o}{1 + \sin \phi}$$

where ϕ_o is the reference latitude where the projection is "true" (ϕ_o = 60 ° in the CMC Polar Stereographic Projection) and ϕ is the latitude on which the distance lies.

Now, if ∂x and ∂y represent distances on the polar stereographic projection and ∂x_s, and ∂y_s, represent the corresponding true distances on the sphere of the earth, then from the discussion on map factor it is clear that

$$\partial x = m \, \partial x_s$$

and

$$\partial y = m \, \partial y_s \quad .$$

With these two equations, it is possible to write

$$\frac{\partial x_s}{\partial t} = \frac{1}{m} \frac{\partial x}{\partial t}$$

$$\frac{\partial y_s}{\partial t} = \frac{1}{m} \frac{\partial y}{\partial t}$$

In vector form these two equations can be written as

$$\vec{v}_s = \frac{\vec{v}}{m} \qquad \ldots (2.1)$$

Defining $\vec{i}$ and $\vec{j}$ to be unit vectors of the polar stereographic coordinate system corresponding to the x- and y-axis, respectively, the pressure gradient is

$$\vec{\nabla} p = \frac{\partial p}{\partial x} \vec{i} + \frac{\partial p}{\partial y} \vec{j}.$$

This can be rewritten as

$$\vec{\nabla} p = \frac{\partial x_s}{\partial x} \frac{\partial p}{\partial x_s} \vec{i} + \frac{\partial y_s}{\partial y} \frac{\partial p}{\partial y_s} \vec{j} \quad ,$$

so that

$$\vec{\nabla} p = \frac{1}{m} \vec{\nabla}_s p \quad ,$$

or alternatively,

$$\vec{\nabla}_s p = m \vec{\nabla} p \quad . \qquad \ldots (2.2)$$

With the equation relating the wind velocity on the earth's surface (equation 2.1) to that on the polar stereographic projection and the equation relating the pressure gradient on the earth's surface to that on the polar stereographic projection (equation 2.2), one can do two simple substitutions in the geostrophic wind equation and obtain its counterpart for the polar stereographic projection:

$$\vec{v} = \vec{k} \times \frac{m^2}{f\rho} \vec{\nabla} p \quad .$$

The length unit used in this equation is the polar-stereographic unit, which equals the conventional metre only at the reference latitude. The

grid used internally is the square grid of unit length which is constructed from the polar stereographic grid. The transformation from the polar stereographic grid to the square grid is done with scaling factors C_x and C_y. The dimensions of the polar stereographic grid used varies with data availability. Define w_x to be the dimension of the grid in the x-direction in CMC length units, and w_y to be the dimension of the grid in the y-direction in CMC length units. The scaling factors are thus given by

$$C_x = w_x \times 381{,}000$$

and

$$C_y = w_y \times 381{,}000$$

The dimension of C_x and C_y is length and the unit is the metre because one CMC grid length is equal to 381,000 polar-stereographic units. Choosing α and β as the coordinates of the square grid, the suitable transformation from the CMC polar stereographic is described by

$$\alpha = \frac{x}{C_x}$$

and

$$\beta = \frac{y}{C_y} \quad .$$

Noting from this that

$$\partial x = C_x \partial \alpha$$

and

$$\partial y = C_y \partial \beta,$$

the geostrophic wind in component form in the OME modified CMC Grid from computations in the square grid is

$$v = \frac{m^2}{f\rho} \frac{1}{C_x} \frac{\partial p}{\partial \alpha} \qquad \ldots (2.3)$$

$$u = -\frac{m^2}{f\rho} \frac{1}{C_y} \frac{\partial p}{\partial \beta} \qquad \ldots (2.4)$$

The units for these wind velocity components are the polar-stereographic unit per second.

The geostrophic wind components for the surface calculated by the subroutine VELO are those given by equations (2.3) and (2.4). VELO also carries calculations a couple of steps further. With the two components it calculates the wind direction in OME modified CMC grid,

$$\theta = \arctan\left(\frac{v}{u}\right) \quad ,$$

and the wind speed,

$$s = \sqrt{u^2 + v^2} \quad .$$

Furthermore the wind speed is converted into the units of polar-stereographic kilometres per hour in the following manner:

$$s = \sqrt{u^2 + v^2} \times 3600 \frac{s}{h} \times \frac{km}{1000\ m}$$

or $$s = (\sqrt{u^2 + v^2}) \times 3.6 \quad .$$

This conversion to wind speed and direction serves no real purpose for when the subroutine NEWXY is used to calculate the next point in the trajectory it must use the u and v components of the wind. To do so it calculates

$$\Delta d = \frac{s}{\Delta t \times C_s}$$

where s is in polar-stereographic kilometres per hour, Δt is in hours, and C_s is 381 polar-stereographic kilometres so that Δd is in the unit of length of the OME modified CMC grid. The displacements in the α and β coordinates are

$$\Delta\alpha = \Delta d \cos \theta$$

and

$$\Delta\beta = \Delta d \sin \Theta,$$

respectively.

A noticeable reduction in computer time could be achieved by calculating the velocity components alone using units of length per hour rather than converting the wind velocity to and from a wind speed and direction, and changing the unit of wind speed as is presently done.

In the subroutine VELO the density at the surface is assumed to be a constant 1.29 kg/m^3. This is an approximation which affects the calculation of the geostrophic wind since density is one of the factors in the equation

$$\vec{v}_s = \vec{k} \times \frac{1}{f\rho} \vec{\nabla}_s p \quad .$$

Now the surface for the purpose of this study has been taken to be mean sea level and it must be noted that very few land stations lie at this elevation so that the density of the air at mean sea level, if estimated by some algorithm, would be a fictitious value. This is the reasoning behind which the decision was made to let density be a constant in the mean sea level version of OME's Lagrangian Model. Nevertheless, one can by a simple calculation estimate the effects of this assumption. Let us

examine two meteorological extremes: a cold high and a warm low. Suppose the temperature to be -20°C and the surface pressure to be 1030 mb in the cold high. This results in a density of 1.42 kgm^{-3} in dry air. In this case the constant density assumption reduces the geostrophic wind speed by 9.2%. For the warm low, suppose the temperature is 30°C and the pressure is 980 mb. The density of dry air is then 1.13 kgm^{-3}. In this case the constant density assumptions increases the geostrophic wind speed by 14.2%. Clearly the effects of the constant density assumption on the calculated geostrophic wind value are not severe and the use of a constant density is justified. The value of 1.26 kgm^{-3} for the density falls within the range of the two extremes given by the preceeding synoptic examples and is close to the density at mean sea level of 1.225 kgm^{-3} given by the ICAO Standard Atmosphere (where the pressure is 1013.25 mb and the temperature is 288.15°K).

The determination of the latitude of a point in the OME-modified CMC polar stereographic grid and the subsequent calculation of the map factor is performed in the subroutine CMCLL. This subroutine also calculates the longitude of the point but this is not used in the model. The CMC polar-stereographic grid is constructed so that the origin coincides with the North Pole and the positive x axis is aligned with 10 °E longitude, so the negative y-axis is aligned with 80 °W, and the latitude where the projection is true is 60 °N. Let x_c and y_c denote the CMC coordinates.

The OME-modified coordinates, denoted x_E and y_E, are given by

$$x_E = x_c + 26$$

and

$$y_E = y_c + 28$$

Since the longitude of a point is not used in the model, the calculation of latitude will be discussed only. Given the OME-modified coordinates, one must transform first to the CMC coordinates. With the aid of Figure 2.1, the calculation of latitude is straightforward. From the geometry of Figure 2.1, it follows that:

$$\tan \theta = \frac{d}{a(1 + \sin \phi_o)}$$

where $d = \sqrt{x_c^2 + y_c^2}$

and a is the mean radius of the earth. From the geometry of isosceles triangles,

$$\phi = \pi - 2 (\pi/2 - \theta)$$

or

$$\phi = 2\theta$$

Noting that $\phi = \frac{\pi}{2} - \psi$

reveals $\phi = \frac{\pi}{2} - 2\theta$

or

$$\phi = \frac{\pi}{2} - 2 \arctan \left[\sqrt{\frac{(x_E - 26)^2 + (y_E - 28)^2}{a(1 + \sin \phi_o)}}\right]$$

as the required result. Notice that the mean radius of the earth must be expressed in CMC length units, that is, a = 16.7. This is not exactly what is coded in CMCLL.

Instead, what is given is

$$\phi = \frac{\pi}{2} - 2 \arctan \left[\sqrt{\frac{(x_E - 26)^2 + (y_E - 28)^2}{a(1 + \sin \phi_o)}}\right] + E$$

where E = 0.005 radian. The deviation from what the calculation ought to be is neglible. But it was interesting to learn that this small adjustment was added at some time in the past so that latitudes like 49.99 ° were rounded to 50 °. This is poor programming style. Cosmetic adjustments to printed results should not be incorporated in utility subroutines and we recommend that this practice be avoided.

The calculation of the map factor by subroutine CMCLL is done using

$$m_{\cdot} = \frac{1 + \sin \phi_o}{1 + \sin \phi} \quad .$$

In summary, examination of the FORTRAN source code for the Lagrangian Model revealed no errors in the translation of formulae nor in the algorithm responsible for generating the trajectories. Due to time limitations, an audit was not done of either the input or output segments of the code. We did not examine the code responsible for fitting the two dimensional orthogonal polynominals to the mean sea level pressure data because we received assurances that this code had been well studied in the past and therefore we need not concern ourselves with this.

It may be said that documentation of the model has been rather thin in the past. With our analysis we hope that we have been able to illuminate some of the facts of the model that have been obscured from view, particularly, the assumption in the calculation of the man sea level geostrophic wind calculation of constant density. The reasons for using this assumption are sound and there is no reason for not documenting them.

Aside from a few minor comments that have been made and a suggestion or two to make the code more efficient (and thus less expensive to run), no deficiencies have ben identified in the Ministry's Lagrangian Model.

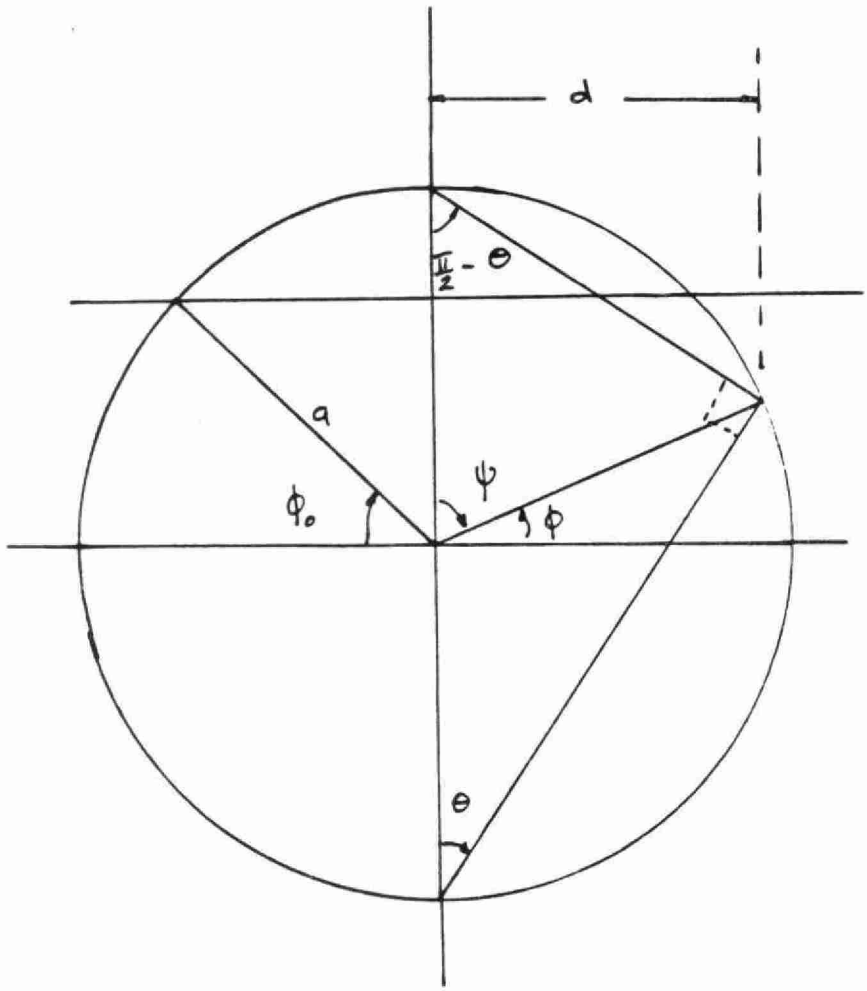


Figure 2.1. Polar stereographic projection where $\phi_o = 60°N$, and a = 6.37 km is the mean radius of the earth.

3. MODIFICATION OF MODEL TO CALCULATE 850 mb TRAJECTORIES

The modification of the Ministry's Long-Range Lagrangian Model to calculate 850 mb trajectories instead of surface trajectories is by no means complicated. To begin with, we replace the surface geostrophic with the isobaric coordinate form of the geostrophic wind equation:

$$\vec{v}_p = \vec{k} \times \frac{1}{f} \vec{\nabla}_p \Phi \quad ,$$

where the subscript p serves to remind that the gradient must be calculated on a constant pressure surface, the wind velocity is for a point on that surface, and Φ is a function of height z that is defined to be the work required to lift a unit mass to a height z above mean sea level. An equation for Φ is

$$\Phi(z) = \int_0^z g\,dz \quad .$$

The derivation of the isobaric coordinate form of the geostrophic equation is well known and will not be repeated here. Nevertheless, a discussion of the derivation can be found in Chapter 3 of Holton (1979). It is convenient to replace $\Phi(z)$ in the geostrophic wind equation by the geopotential height Z that is defined as

$$Z = \frac{\Phi(z)}{g_o} \quad ,$$

where $g_o = 9.80665\ ms^{-2}$, the average global acceleration of gravity at mean sea level. With this substitution, the geostrophic wind equation in isobaric coordinates becomes

$$\vec{v}_p = \vec{k} \times \frac{g_o}{f} \vec{\nabla}_p Z \quad .$$

Note that this equation is valid for any constant pressure surface and not just 850 mb. Fortunately, geopotential height at selected pressure levels are the values reduced from radiosonde ascent and collected for dissemination. So no further data preparation is required.

In passing, we note that one of the touted advantages of the isobaric-coordinates form of the geostrophic wind equation over its constant altitude counterpart is that density no longer appears as an explicit parameter in the equation. The difficulty with the constant altitude form of the equation is that if the pressure gradient is the same at two points, the geostrophic wind will be different at the two points if the density is not the same.

The only other changes to the model result from the limited frequency of observations and the sparse observational network. Radiosondes are released only twice daily, at 00UT and 12UT, and the number of stations making upper air observations are far fewer than the number of surface observing stations. The 850 mb version uses 12h time steps

between trajectory points rather than the 3 h and 6 h interval between points for the surface version. At 850 mb it is not feasible to fit an orthogonal polynomial surface to the small number of station values, so an objective analysis must be done to produce values of geopotential height on a grid and these gridded values are then used to fit the orthogonal polynomial surface.

It should be noted that while the modification made to the model was done so that 850 mb trajectories could be generated, it is certainly possible to use the modified code as is for any of the other nine mandatory pressure levels whose geopotential heights are routinely reported twice daily around the world. So this version of the Lagrangian model that has been developed is not so much the 850 mb version of the model as it is the upper air version.

4. GENERATION OF SURFACE TRAJECTORIES

Mean sea level trajectories were generated at three hour intervals in the months of January and July of 1982 for three source locations: Sudbury, Ontario; Baldwin, Illinois; and a location in southwestern Pennsylvania. The pressure data were obtained from two sources. One was mean sea level pressure reported by surface observing stations. The other was mean sea level pressure reduced from 1000 mb geopotential heights at 28 points from an objectively analysed grid. As can be seen in Figure 4.1, these 28 points lie, for the most part, over large bodies of water where there are no surface weather stations. The limited extent of the gridded 850 mb geopotential heights has resulted in a restricted rectangular boundary for trajectory generation. This boundary constrains the x-coordinate to lie between 20 and 30, inclusive, and the y-coordinate to lie between 10 and 20, inclusive. For consistency, this same region-of-interest was used for the surface as well. To partially compensate for boundary effects on trajectory calculation, a number of the additional 28 points of mean sea level pressure lie along $y = 10$ and $x = 30$.

For a few time periods there are no pressure data available at all (for a variety of reasons). So a decision was made to halt a trajectory at the latest point if there was no data available at the next time step. Moreover, any trajectory that does not survive at least 24 h is not output to the data file.

The time-step for the first 18 h of travel-time is 3 h, and then 6 h thereafter until the trajectory is terminated at 96 h of elapsed time.

Trajectories are intiated 8 times per day at 3 h intervals beginning at 00UT on the first day of each month. Since the data for each month include two more days worth of the following month, the last trajectory is initiated at 21Z of the first day of the following month (either 1 February or 1 August).

The estimated trajectory - statistics for Sudbury are given in Table 4.1 for January and in Table 4.2 for July. The number of trajectories initiated (see the entry under the column marked WEIGHT for time 0h) differs between the two months because of lack of pressure data at certain times.

Tables 4.3 and 4.4 report the estimated statistics calculated for the set elapsed times of trajectories initiated from Baldwin for the monthly periods of January and July, respectively.

The statistics estimated from the trajectories initiated from the site in Pennsylvania are given in Table 4.5 for January and in Table 4.6 for July.

Table 4.1: Estimated trajectory-statistics at mean sea level for Sudbury, January 1982.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: H201 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	185.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	185.	100.0	25.785 ± 0.022	15.569 ± 0.023	0.296	0.319	-0.026	-16.4
6.	185.	100.0	25.798 ± 0.046	15.550 ± 0.047	0.625	0.636	-0.092	-13.2
9.	185.	100.0	25.826 ± 0.067	15.506 ± 0.068	0.909	0.921	-0.174	-11.9
12.	184.	99.5	25.886 ± 0.084	15.429 ± 0.086	1.135	1.165	-0.257	-11.3
18.	179.	96.8	26.041 ± 0.111	15.282 ± 0.119	1.490	1.586	-0.487	-12.6
24.	172.	93.0	26.078 ± 0.132	15.121 ± 0.141	1.736	1.853	-0.760	-14.1
30.	153.	82.7	25.998 ± 0.153	15.025 ± 0.169	1.894	2.086	-0.652	-10.3
36.	135.	73.0	25.878 ± 0.173	14.921 ± 0.192	2.013	2.235	-0.389	-5.5
42.	118.	63.8	25.746 ± 0.189	14.959 ± 0.213	2.056	2.318	0.246	3.3
48.	103.	55.7	25.618 ± 0.203	15.140 ± 0.229	2.059	2.325	0.383	5.2
54.	86.	46.5	25.621 ± 0.215	15.681 ± 0.214	1.990	1.988	0.143	2.1
60.	79.	42.7	25.536 ± 0.220	15.758 ± 0.236	1.955	2.095	-0.338	-5.1
66.	72.	38.9	25.449 ± 0.243	15.494 ± 0.251	2.062	2.133	-0.704	-9.4
72.	63.	34.1	25.379 ± 0.278	15.460 ± 0.269	2.208	2.137	-0.922	-10.7
78.	53.	28.6	25.297 ± 0.316	15.410 ± 0.287	2.303	2.089	-0.787	-8.4
84.	43.	23.2	25.586 ± 0.350	15.253 ± 0.298	2.293	1.953	-0.683	-7.4
90.	35.	18.9	25.754 ± 0.407	15.249 ± 0.294	2.409	1.737	-0.934	-9.1
96.	26.	14.1	25.624 ± 0.502	14.961 ± 0.328	2.559	1.672	-0.787	-6.9

Table 4.2: Estimated trajectory-statistics at mean sea level for Sudbury, July 1982.

SOURCE STATION IS: 1 - ONT SUDHURY PERIOD: H207 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	223.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	223.	100.0	25.925 ± 0.013	15.573 ± 0.011	0.191	0.158	0.003	4.6
6.	223.	100.0	26.059 ± 0.026	15.589 ± 0.021	0.389	0.312	0.012	4.6
9.	223.	100.0	26.174 ± 0.039	15.603 ± 0.029	0.567	0.439	0.028	4.9
12.	223.	100.0	26.281 ± 0.049	15.615 ± 0.037	0.739	0.554	0.053	5.6
18.	223.	100.0	26.477 ± 0.070	15.636 ± 0.051	1.044	0.757	0.140	7.3
24.	223.	100.0	26.668 ± 0.089	15.675 ± 0.063	1.309	0.945	0.275	9.1
30.	210.	94.2	26.837 ± 0.101	15.772 ± 0.077	1.466	1.122	0.455	12.0
36.	198.	88.8	27.013 ± 0.112	15.901 ± 0.092	1.577	1.301	0.650	14.7
42.	180.	80.7	27.101 ± 0.121	15.964 ± 0.105	1.618	1.415	0.627	13.5
48.	164.	73.5	27.141 ± 0.125	16.098 ± 0.127	1.605	1.623	0.662	14.4
54.	142.	63.7	27.137 ± 0.133	16.060 ± 0.144	1.583	1.715	0.563	12.7
60.	121.	54.3	27.099 ± 0.135	16.024 ± 0.161	1.486	1.770	0.467	11.9
66.	111.	49.8	27.200 ± 0.137	16.074 ± 0.175	1.444	1.848	0.365	9.9
72.	100.	44.8	27.179 ± 0.138	16.130 ± 0.194	1.377	1.944	0.442	13.1
78.	91.	40.8	27.156 ± 0.142	16.103 ± 0.213	1.355	2.034	0.318	9.8
84.	78.	35.0	27.087 ± 0.152	15.986 ± 0.236	1.347	2.087	0.203	6.4
90.	66.	29.6	26.982 ± 0.157	15.854 ± 0.258	1.274	2.097	0.269	9.4
96.	59.	26.5	26.871 ± 0.156	15.765 ± 0.268	1.200	2.058	0.102	4.1

Table 4.3: Estimated trajectory-statistics at mean sea level for Baldwin, January 1983.

SOURCE STATION IS: 2 - ILL HALOMTN PERIOD: H201 HEIGHT: SEC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	185.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	171.	92.4	23.405 ± 0.023	13.062 ± 0.027	0.309	0.351	0.014	8.4
6.	163.	88.1	23.324 ± 0.051	13.022 ± 0.054	0.657	0.695	0.091	11.9
9.	155.	83.8	23.225 ± 0.079	13.015 ± 0.079	0.991	0.978	0.231	13.5
12.	139.	75.1	23.145 ± 0.103	13.098 ± 0.097	1.219	1.140	0.246	9.4
18.	116.	62.7	23.328 ± 0.145	13.430 ± 0.130	1.557	1.400	0.328	7.7
24.	95.	51.4	23.485 ± 0.180	13.905 ± 0.147	1.753	1.430	0.332	6.2
30.	78.	42.2	23.563 ± 0.219	14.151 ± 0.172	1.933	1.517	0.763	11.5
36.	65.	35.1	23.397 ± 0.252	14.261 ± 0.181	2.034	1.461	0.669	9.2
42.	56.	30.3	23.107 ± 0.294	14.150 ± 0.218	2.200	1.628	0.092	1.1
48.	46.	24.9	22.645 ± 0.304	14.349 ± 0.271	2.060	1.937	-0.997	-13.2
54.	34.	18.4	22.253 ± 0.351	15.305 ± 0.294	2.045	1.712	-0.810	-11.0
60.	29.	15.7	22.000 ± 0.330	16.195 ± 0.295	1.775	1.587	-1.341	-23.1
66.	25.	13.5	22.135 ± 0.381	16.889 ± 0.318	1.903	1.591	-1.263	-19.2
72.	20.	10.8	22.256 ± 0.481	17.259 ± 0.224	2.149	1.002	-1.392	-16.8
78.	13.	7.0	22.966 ± 0.710	16.756 ± 0.334	2.561	1.205	-2.372	-19.9
84.	10.	5.4	22.718 ± 0.548	16.767 ± 0.328	2.049	1.037	-1.254	-16.7
90.	10.	5.4	22.586 ± 0.533	16.790 ± 0.249	2.022	0.952	-1.028	-14.1
96.	8.	4.3	23.017 ± 0.584	16.903 ± 0.253	1.662	0.715	-0.972	-19.4

Table 4.4: Estimated trajectory-statistics at mean sea level for Baldwin, July 1982.

SOURCE STATION IS: 2 - ILL BALDWIN PERIOD: 8207 HEIGHT: SFC (UNWEIGHTED)

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	223.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	223.	100.0	23.494 ± 0.011	13.193 ± 0.009	0.168	0.128	0.009	16.8
6.	223.	100.0	23.583 ± 0.022	13.285 ± 0.017	0.335	0.259	0.034	16.8
9.	223.	100.0	23.659 ± 0.032	13.370 ± 0.025	0.481	0.377	0.072	17.2
12.	223.	100.0	23.733 ± 0.042	13.454 ± 0.033	0.622	0.492	0.123	17.6
18.	223.	100.0	23.875 ± 0.059	13.621 ± 0.047	0.884	0.708	0.258	18.3
24.	223.	100.0	24.019 ± 0.075	13.792 ± 0.061	1.136	0.906	0.441	18.9
30.	215.	96.4	24.203 ± 0.095	13.981 ± 0.075	1.387	1.096	0.682	19.5
36.	207.	92.8	24.400 ± 0.113	14.175 ± 0.097	1.631	1.258	0.939	19.4
42.	199.	89.2	24.600 ± 0.132	14.366 ± 0.098	1.860	1.381	1.164	18.6
48.	192.	86.1	24.802 ± 0.151	14.560 ± 0.107	2.086	1.482	1.382	17.6
54.	184.	82.5	24.984 ± 0.169	14.741 ± 0.119	2.280	1.616	1.640	17.5
60.	175.	78.5	25.155 ± 0.185	15.039 ± 0.133	2.449	1.764	1.852	17.2
66.	161.	72.2	25.170 ± 0.195	15.229 ± 0.150	2.479	1.898	1.944	17.6
72.	144.	64.6	25.155 ± 0.201	15.329 ± 0.167	2.407	2.003	2.155	20.4
78.	131.	58.7	25.199 ± 0.210	15.467 ± 0.180	2.403	2.065	2.227	21.1
84.	117.	52.5	25.151 ± 0.227	15.517 ± 0.190	2.457	2.051	2.426	21.9
90.	105.	47.1	25.475 ± 0.240	15.634 ± 0.208	2.460	2.136	2.496	22.4
96.	97.	43.5	25.427 ± 0.259	15.713 ± 0.226	2.547	2.221	2.571	21.6

Table 4.5: Estimated trajectory-statistics at mean sea level for Pennsylvania, January 1982.

SOURCE STATION IS: 3 - PEN COMMJO ALLEG PERIOD: 8201 HEIGHT: SFC UNWEIGHTED

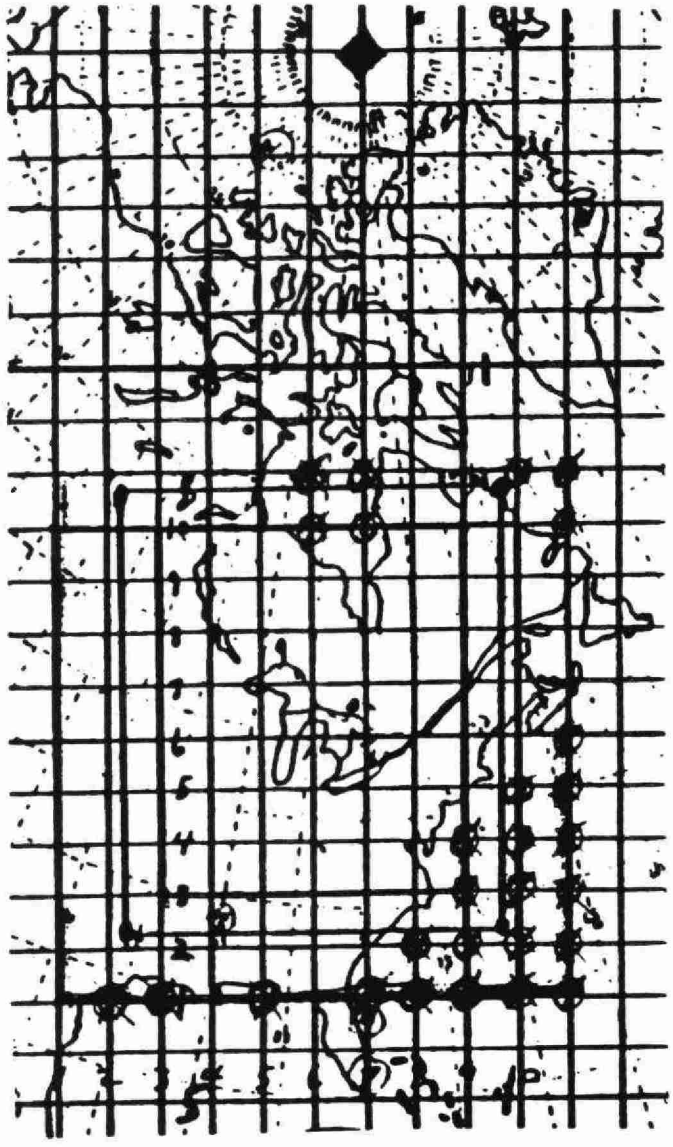
TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	185.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	184.	99.5	26.274 ± 0.022	13.742 ± 0.029	0.300	0.399	-0.008	-4.8
6.	182.	98.4	26.334 ± 0.045	13.851 ± 0.060	0.623	0.811	0.006	0.9
9.	181.	97.8	26.324 ± 0.064	13.941 ± 0.087	0.923	1.169	0.072	4.8
12.	178.	96.2	26.295 ± 0.089	13.973 ± 0.109	1.189	1.458	0.176	7.1
18.	163.	88.1	26.269 ± 0.123	14.035 ± 0.149	1.574	1.906	0.807	18.1
24.	143.	77.3	26.195 ± 0.140	14.234 ± 0.179	1.673	2.135	0.982	19.3
30.	121.	65.4	26.018 ± 0.155	14.306 ± 0.204	1.705	2.243	1.116	21.0
36.	99.	53.5	25.972 ± 0.173	14.545 ± 0.229	1.724	2.277	0.971	18.1
42.	82.	44.3	25.920 ± 0.197	14.635 ± 0.250	1.787	2.266	0.850	14.9
48.	71.	38.4	25.650 ± 0.236	14.634 ± 0.241	1.985	2.033	0.241	3.5
54.	64.	34.6	25.385 ± 0.260	14.480 ± 0.238	2.082	1.904	-0.339	-4.5
60.	59.	31.9	25.272 ± 0.269	14.517 ± 0.238	2.070	1.930	-0.159	-2.1
66.	52.	28.1	25.169 ± 0.274	14.601 ± 0.250	1.975	1.803	0.242	3.6
72.	46.	24.9	25.442 ± 0.270	14.582 ± 0.289	1.833	1.954	0.399	6.8
78.	40.	21.6	25.609 ± 0.297	14.386 ± 0.312	1.877	1.974	0.005	0.1
84.	36.	19.5	25.472 ± 0.327	14.530 ± 0.361	1.961	2.168	0.335	5.0
90.	29.	15.7	25.306 ± 0.332	14.347 ± 0.407	1.788	2.193	0.656	11.6
96.	25.	13.5	25.252 ± 0.333	14.169 ± 0.462	1.665	2.310	0.802	16.1

Table 4.6: Estimated trajectory-statistics at mean sea level for Pennsylvania, July 1983.

SOURCE STATION IS: 3 - PEN CONMJO ALLEG PERIOD: 8207 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	223.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	223.	100.0	26.232 ± 0.009	13.675 ± 0.010	0.141	0.143	0.009	24.6
6.	223.	100.0	26.307 ± 0.019	13.705 ± 0.020	0.286	0.297	0.039	25.7
9.	223.	100.0	26.374 ± 0.028	13.736 ± 0.030	0.417	0.442	0.086	26.2
12.	223.	100.0	26.439 ± 0.037	13.770 ± 0.039	0.546	0.589	0.145	25.9
18.	223.	100.0	26.566 ± 0.053	13.841 ± 0.057	0.792	0.858	0.272	23.4
24.	223.	100.0	26.691 ± 0.070	13.915 ± 0.072	1.046	1.072	0.388	19.6
30.	210.	94.2	26.745 ± 0.085	14.007 ± 0.082	1.239	1.192	0.419	15.3
36.	193.	86.5	26.699 ± 0.096	14.086 ± 0.090	1.327	1.252	0.434	13.8
42.	177.	79.4	26.668 ± 0.108	14.177 ± 0.095	1.432	1.268	0.560	15.3
48.	162.	72.6	26.636 ± 0.119	14.239 ± 0.097	1.503	1.235	0.657	16.2
54.	143.	64.1	26.502 ± 0.119	14.253 ± 0.101	1.425	1.214	0.638	17.4
60.	132.	59.2	26.545 ± 0.130	14.312 ± 0.105	1.497	1.210	0.639	15.9
66.	122.	54.7	26.595 ± 0.142	14.398 ± 0.107	1.569	1.184	0.593	13.5
72.	112.	50.2	26.623 ± 0.152	14.490 ± 0.110	1.612	1.164	0.560	12.2
78.	104.	46.6	26.691 ± 0.164	14.614 ± 0.111	1.678	1.128	0.643	12.9
84.	96.	43.0	26.748 ± 0.176	14.743 ± 0.112	1.726	1.095	0.787	14.8
90.	88.	39.5	26.797 ± 0.186	14.880 ± 0.116	1.743	1.085	0.955	17.5
96.	81.	36.3	26.897 ± 0.194	15.067 ± 0.125	1.750	1.121	1.202	21.4

Figure 4.1. Points of mean sea level pressure.



5. GENERATION OF 850 mb TRAJECTORIES

The data for the upper air version of the Lagrangian Model are taken from an objectively analysed grid of 850 mb geopotential height. This grid consists of 121 regularly spaced points and extends parallel to the x-axis from coordinates 20 to 30, inclusive, and parallel to the y-axis from coordinates 10 to 20, inclusive. The geopotential height observations are available for 00UT and 12UT only.

For the 850 mb trajectories it was possible to use only a time-step of 12 h. If data were unavailable at a time-step then the trajectories would end at the previously calculated point where data were available. Again, a trajectory would not be reported if it failed to attain an elapsed travel-time of at least 24 h. Trajectories were generated for 96 h of travel-time. Trajectories are initiated every 12 h beginning at 00UT on the first day of each month. As with the surface data each monthly data set includes two days from the following month. So the last time of trajectory initiation is 12 h of the first day of either February or August.

Statistics estimated at each travel-time for trajectories initiated from Sudbury are reported in Table 5.1 for January 1982 and in Table 5.2 for July of the same year. Similar statistics for trajectories initiated from Baldwin are listed in Tables 5.3 and 5.4 for January and July, respectively. In Tables 5.5 and 5.6 are the

statistics estimated from trajectories generated from the source in Pennsylvania for January and July respectively.

Some general comments can be made about these results. There are significantly fewer trajectories initiated at 850 mb then at the mean sea level because at 850 mb observations are available only twice a day, whereas the mean sea level trajectory-generation used reported data at 3h intervals. As with the surface trajectories, there are fewer trajectories initiated in January than in July because of more missing data in the month of January than July. It is comforting to note that the estimates of the second order moments are of the same order of magnitude for 850 mb as for the surface. But the angles of the major axis of the probability ellipse to the axis of the coordinate system are larger and show more variability in time as the trajectory progresses for the 850 mb level.

Table 5.1: Estimated trajectory-statistics at 850 mb for Sudbury, January 1982.

SOURCE STATION IS: 1 - ONT SUDHURY PERIOD: 8201 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
12.	45.	80.4	26.595 ± 0.160	15.952 ± 0.160	1.076	1.073	1.038	41.9
24.	38.	67.9	27.036 ± 0.235	15.886 ± 0.288	1.451	1.778	2.077	44.6
36.	25.	44.6	26.926 ± 0.320	14.960 ± 0.320	1.598	1.602	1.806	35.3
48.	13.	23.2	26.046 ± 0.381	13.794 ± 0.348	1.372	1.253	0.334	10.1
60.	10.	17.9	26.079 ± 0.529	13.887 ± 0.470	1.989	1.488	1.021	14.5
72.	5.	8.9	26.006 ± 0.370	14.798 ± 0.568	0.828	1.271	0.203	16.5
84.	4.	7.1	26.500 ± 0.301	14.903 ± 0.679	0.602	1.356	-0.381	-46.4
96.	4.	7.1	27.015 ± 0.565	14.903 ± 0.584	1.130	1.167	-1.128	-41.4

Table 5.2: Estimated trajectory-statistics at 850 mb for Sudbury, July 1982.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 8207 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	64.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
12.	64.	100.0	26.695 ± 0.073	16.071 ± 0.077	0.584	0.619	0.307	42.0
24.	61.	95.3	27.456 ± 0.110	16.540 ± 0.126	0.861	0.984	0.644	41.0
36.	49.	76.6	27.938 ± 0.149	16.817 ± 0.181	1.042	1.267	1.048	44.0
48.	36.	56.3	28.213 ± 0.209	16.743 ± 0.239	1.255	1.436	1.494	43.5
60.	23.	35.9	28.103 ± 0.309	16.267 ± 0.334	1.477	1.604	1.986	42.3
72.	16.	25.0	27.938 ± 0.447	15.912 ± 0.477	1.786	1.910	2.834	41.6
84.	11.	17.2	27.478 ± 0.590	15.463 ± 0.693	1.959	2.298	3.931	45.7
96.	8.	12.5	27.142 ± 0.519	14.584 ± 0.824	1.751	2.332	3.288	47.0

Table 5.3: Estimated trajectory-statistics at 850 mb for Baldwin, January 1982.

SOURCE STATION IS: 2 - ILL BALDWIN PERIOD: A201 HEIGHT: A50 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
12.	48.	85.7	24.889 ± 0.160	13.551 ± 0.138	1.110	0.954	0.935	37.2
24.	39.	69.6	26.573 ± 0.208	14.128 ± 0.164	1.297	1.025	0.823	26.1
36.	27.	48.2	27.242 ± 0.275	14.268 ± 0.295	1.435	1.533	1.327	32.8
48.	17.	30.4	27.539 ± 0.419	14.222 ± 0.434	1.723	1.791	1.621	28.6
60.	10.	17.9	26.866 ± 0.574	13.209 ± 0.340	1.817	1.075	0.435	7.5
72.	5.	8.9	25.983 ± 0.726	13.128 ± 0.202	1.624	0.451	-0.640	-13.6
84.	4.	7.1	25.497 ± 0.529	13.077 ± 0.249	1.257	0.498	-0.439	-15.5
96.	3.	5.4	24.986 ± 0.515	13.219 ± 0.330	1.065	0.676	-0.051	-2.6

Table 5.4: Estimated trajectory-statistics at 850 mb for Baldwin, July 1982.

SOURCE STATION IS: 2 - ILL BALDWIN PERIOD: 8207 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	64.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
12.	64.	100.0	23.969 ± 0.086	13.264 ± 0.065	0.689	0.518	0.327	34.6
24.	64.	100.0	24.583 ± 0.157	13.523 ± 0.123	1.256	0.983	1.113	35.2
36.	62.	96.9	25.156 ± 0.197	13.765 ± 0.163	1.555	1.286	1.666	34.6
48.	60.	93.8	25.778 ± 0.226	14.046 ± 0.192	1.751	1.489	1.971	32.7
60.	56.	87.5	26.307 ± 0.240	14.398 ± 0.234	1.796	1.748	2.407	36.7
72.	50.	78.1	26.781 ± 0.259	14.635 ± 0.277	1.831	1.958	2.592	37.7
84.	42.	65.6	27.168 ± 0.272	14.561 ± 0.249	1.763	1.474	1.939	32.0
96.	29.	45.3	27.032 ± 0.325	14.261 ± 0.295	1.751	1.587	1.156	20.7

Table 5.5: Estimated trajectory-statistics at 850 mb for Pennsylvania, January 1982.

SOURCE STATION IS: 3 - PEN CONMJO ALLEG PERIOD: 8201 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
12.	48.	85.7	26.721 ± 0.167	13.413 ± 0.143	1.158	0.988	0.886	33.5
24.	27.	48.2	26.939 ± 0.294	13.396 ± 0.262	1.527	1.360	1.246	28.1
36.	11.	19.6	27.122 ± 0.438	13.812 ± 0.373	1.451	1.236	0.929	23.8
48.	8.	14.3	27.176 ± 0.525	13.949 ± 0.501	1.486	1.418	0.790	19.7
60.	6.	10.7	27.269 ± 0.569	13.853 ± 0.675	1.393	1.454	0.136	4.0
72.	3.	5.4	26.558 ± 0.799	13.263 ± 0.457	1.385	0.792	-0.274	-8.1
84.	3.	5.4	27.070 ± 0.992	13.389 ± 0.499	1.545	0.864	-1.035	-23.4
96.	2.	3.6	26.518 ± 0.345	14.235 ± 0.082	0.488	0.116	-0.057	-13.4

Table 5.6: Estimated trajectory-statistics at 850 mb for Pennsylvania, July 1982.

SOURCE STATION IS: 3 - PEN CONMJO ALLEG PERIOD: 8207 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	64.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
12.	64.	100.0	26.675 ± 0.078	13.870 ± 0.046	0.623	0.370	0.189	26.0
24.	61.	95.3	27.122 ± 0.149	13.984 ± 0.091	1.167	0.708	0.617	24.4
36.	52.	81.3	27.207 ± 0.183	13.868 ± 0.113	1.322	0.816	0.557	17.7
48.	44.	68.8	27.209 ± 0.196	13.826 ± 0.149	1.301	0.986	0.512	16.8
60.	37.	57.8	27.281 ± 0.212	13.826 ± 0.191	1.298	1.161	0.448	15.1
72.	31.	48.4	27.161 ± 0.207	13.949 ± 0.243	1.150	1.354	0.785	30.7
84.	29.	45.3	27.381 ± 0.225	14.102 ± 0.279	1.213	1.505	0.907	31.7
96.	26.	40.6	27.549 ± 0.246	14.121 ± 0.311	1.253	1.587	0.710	24.3

6. COMPARISON OF 850 mb AND MEAN SEA LEVEL TRAJECTORIES

To aid in the comparison of the statistical properties of 850 mb and mean sea level trajectories, it was decided to construct a filtered set (as it came to be called) of trajectories at each level by including in each set only those trajectories that have a counterpart in the other set that is initiated at the same time and date. Hence, for example, the filtered set of sea level trajectories in January 1982 for Sudbury has the same number of trajectories at the elapsed travel time of 0h as the filtered set of 850 mb trajectories for the same period.

The estimated statistics for the filtered set of trajectories for the two levels, two time periods and three sources are given in Tables 6.1 through 6.12. The captions identify each table clearly, so the identification of each table will not be repeated here.

Given the greater density of surface observing stations as compared to that of upper air stations, one expects fewer trajectories to survive to 96 h of elapsed time at 850 mb than at mean sea level because of the increased likelihood of convergence criterion failure resulting from poorer representation of the 850 mb geopotential height field. Also, one cannot neglect the fact that 850 mb flow has a strong westerly component and therefore more trajectories would be expected to reach the boundaries of the region of interest of 850 mb than at mean sea level. Indeed for Sudbury and the source in Pennsylvania, fewer

trajectories survive at 850 mb than at mean sea level. Interestingly enough more trajectories survive the 96h at the 850 mb level than at the surface for Baldwin, although the numbers are certainly comparable. This counter-intuitive result can be due to the fact that Baldwin is the westernmost location of the three sources.

To really appreciate these statistics, it is best to display them on a map of North America so that one can see the travel and variability of these trajectories in relation to geography. Figures 6.1 and 6.2 contain the means of trajectory points originating from Sudbury for the period January 1982 for the surface and 850 mb levels, respectively. The pattern of mean positions for the surface is rather erratic due to the small number of trajectories constituting the average. With more ensembles of trajectories, the pattern would be more established and regular (as was the case discussed in the main text of this report). In all the figures of this type, a square is drawn to indicate the source location, and triangles are used for the mean location at each time step with line segments connecting the points to help illustrate the time evolution of the mean surface trajectory. For Sudbury in January of 1982, the mean surface trajectory is disorderly and is largely confined to southern Ontario. The 850 mb mean trajectory starts with an anticipated northeastward motion but soon veers southward and displays a disorderly pattern in the states of New York and Pennsylvania.

The mean trajectories in January 1982 at the surface and 850 mb for Baldwin are depicted in Figures 6.3 and 6.4, respectively. These mean trajectories are starkly different. The surface mean trajectory proceeds toward Manitoba where it ends. The 850 mb mean proceeds northeastward and reaches New York State at the 36 h mark but then it doubles-back to complete its journey at 96 h in Ohio. This doubling-back is curious and might result from lack of resolution of the geophysical height surface over the ocean or near-boundary effects - either reason accounting for trajectories terminating before reaching an elapsed time of 96h.

Figures 6.5 and 6.6 depict mean trajectories originating from Sudbury for the averaging period of July 1982 at the surface and 850 mb, respectively. Both mean trajectories for the first 36h move in a northeastward direction through southern Quebec. After that, they go their own separate ways. The surface mean trajectory shows an erratic pattern after 36h, which is thought to be symptomatic of small sample size for these travel-times. The 850 mb mean trajectory after 36h proceeds nearly parallel to the coastline through southwestern Quebec to Maryland. This too most likely results from small sample size and additionally near boundary effects.

The mean trajectories calculated from Baldwin, using the July data, for the surface and 850 mb are illustrated in Figures 6.7 and 6.8, respectively. Both proceed in a northeastward direction. The surface

mean trajectory reaches past Sault St. Marie to approch Sudbury. The 850 mb mean trajectory finishes its 96h journey in the tri-state area of New York, New Jersey, and Pennsylvania. These mean trajectories together show a remarkably coherent motion. They correspond quite well to what one would intuitively expect to see.

The last four figures of this part of the report comprise an illustration of mean trajectories together with the associated standard errors in the x and y directions (see main text, Section 4). Unfortunately, for display purposes it was not possible to give the standard errors at each time step, or even at time steps separated by 12 h. An uncluttered and clear picture is possible with standard errors depicted as line segments at time steps separated by 24 h. As can be appreciated from the proceeding figures of mean trajectories for Sudbury, it was not possible to produce informative figures with standard errors for the surface. The mean trajectories without standard errors for the source in Pennsylvania were not presented in this report for they were difficult to follow. So the mean trajectories with standard errors every 24 h, but with each travel point plotted, for Baldwin are illustrated in Figures 6.9 through 6.12. In these figures a line segment that is the length of two standard errors of the x-coordinate is drawn so that the trajectory point is the mid-point of the line segment, and the same sort of operation is done to display the standard error of the y-coordinate. It is certainly reasonable for a physical scientist to look at these figures and think that he is viewing error bars in the x and y directions.

Figure 6.11, which displays information from the surface calculations in January, shows increasing standard errors from 24 h to 48 h but then the standard errors shrink for 72 h and 96 h. This is a small sample effect for at 72 h only 6 of 45 initial trajectories remain. Similarly, for the same average period for the 850 mb trajectories, the standard errors grow from 24 h to 48 h but then the anticipated growth is not seen for 72 h or 96 h. Small sample size is probably the cause since only 5 of the 45 trajectories survive at 72 h.

We are more fortunate with the July trajectories of the filtered set for Baldwin because out of 45 initial trajectories, 23 trajectories at the surface survive at 96 h, and 26 trajectories at 850 mb survive. The initial sample size for both months is small but at least we have the consolation that in July we don't lose all but approximately 5 % as in the case in January. The standard errors for Baldwin in July increase as time progresses at both the surface and 850 mb. On comparing Figures 6.11 and 6.12, one notices that the standard errors are larger for the surface trajectories at all time-steps except 24 h. The standard errors for both levels at 96h are still roughly comparable. If one were to superimpose Figure 6.12 over Figure 6.11, one would find no overlap of rectangular regions defined by standard errors from the two different levels at the same elapsed time.

Table 6.1: Estimated statistics for filtered set of trajectories at mean sea level for Sudbury. January 1982.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: A201 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	45.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	45.	100.0	25.772 ± 0.047	15.575 ± 0.048	0.313	0.323	-0.032	-18.1
6.	45.	100.0	25.773 ± 0.096	15.556 ± 0.096	0.641	0.642	-0.099	-13.6
9.	45.	100.0	25.788 ± 0.133	15.513 ± 0.139	0.893	0.930	-0.189	-13.3
12.	44.	97.8	25.853 ± 0.172	15.442 ± 0.176	1.143	1.170	-0.351	-15.0
18.	43.	95.6	26.049 ± 0.230	15.221 ± 0.247	1.507	1.619	-0.629	-15.5
24.	41.	91.1	26.135 ± 0.286	15.032 ± 0.286	1.832	1.831	-1.094	-18.1
30.	39.	86.7	26.167 ± 0.323	14.925 ± 0.330	2.017	2.059	-0.771	-10.7
36.	33.	73.3	25.799 ± 0.368	14.994 ± 0.408	2.117	2.344	-0.695	-8.8
42.	29.	64.4	25.709 ± 0.362	14.819 ± 0.423	1.949	2.275	0.224	3.4
48.	24.	53.3	25.572 ± 0.359	15.274 ± 0.473	1.759	2.315	-0.254	-4.7
54.	21.	46.7	25.431 ± 0.377	15.626 ± 0.468	1.729	2.146	-0.252	-4.8
60.	19.	42.2	25.351 ± 0.417	15.476 ± 0.546	1.820	2.380	-0.549	-9.4
66.	18.	40.0	25.328 ± 0.422	15.086 ± 0.523	1.791	2.221	-0.756	-13.3
72.	16.	35.6	25.443 ± 0.478	14.843 ± 0.548	1.911	2.193	-1.213	-18.4
78.	15.	33.3	25.364 ± 0.566	15.003 ± 0.514	2.191	1.990	-1.414	-16.4
84.	12.	26.7	26.300 ± 0.575	14.825 ± 0.580	1.992	2.008	-1.318	-18.4
90.	11.	24.4	26.508 ± 0.548	14.311 ± 0.386	2.150	1.280	-1.426	-17.1
96.	8.	17.8	26.350 ± 0.777	14.204 ± 0.511	2.199	1.445	-0.754	-8.9

Table 6.2: Estimated statistics for filtered set of trajectories at mean sea level for Sudbury. July 1982.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: A207 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
3.	56.	100.0	25.923 ± 0.026	15.571 ± 0.022	0.193	0.163	0.004	6.1
6.	56.	100.0	26.058 ± 0.052	15.583 ± 0.043	0.388	0.121	0.016	6.0
9.	56.	100.0	26.172 ± 0.075	15.590 ± 0.060	0.561	0.450	0.033	5.9
12.	56.	100.0	26.278 ± 0.099	15.600 ± 0.076	0.731	0.567	0.058	6.2
18.	56.	100.0	26.481 ± 0.140	15.615 ± 0.104	1.045	0.780	0.152	8.0
24.	56.	100.0	26.677 ± 0.174	15.647 ± 0.130	1.305	0.971	0.297	9.9
30.	53.	94.6	26.871 ± 0.206	15.746 ± 0.157	1.497	1.142	0.376	9.5
36.	50.	89.3	27.033 ± 0.227	15.896 ± 0.186	1.603	1.315	0.657	14.3
42.	45.	80.4	27.157 ± 0.244	15.932 ± 0.207	1.638	1.392	0.444	9.4
48.	41.	73.2	27.165 ± 0.256	16.112 ± 0.251	1.639	1.606	0.611	12.8
54.	36.	64.3	27.237 ± 0.270	16.009 ± 0.285	1.620	1.708	0.350	7.6
60.	30.	53.6	27.106 ± 0.288	16.001 ± 0.331	1.579	1.815	0.452	10.3
66.	28.	50.0	27.309 ± 0.286	16.043 ± 0.343	1.515	1.817	0.144	3.6
72.	24.	42.9	27.241 ± 0.297	16.158 ± 0.393	1.456	1.925	0.465	12.4
78.	23.	41.1	27.297 ± 0.296	16.135 ± 0.419	1.420	2.009	0.425	11.9
84.	18.	32.1	27.190 ± 0.339	15.933 ± 0.484	1.433	2.054	0.279	7.7
90.	17.	30.4	27.197 ± 0.350	16.193 ± 0.544	1.445	2.243	0.570	15.3
96.	13.	23.2	26.703 ± 0.336	15.872 ± 0.598	1.211	2.157	-0.025	-1.0

Table 6.3: Estimated statistics for filtered set of trajectories at mean sea level for Baldwin. January 1982.

SOURCE STATION IS: 2 - ILL BALDWIN PERIOD: 8201 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	45.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	40.	88.9	23.421 ± 0.051	13.075 ± 0.057	0.321	0.362	0.023	12.5
6.	40.	88.9	23.384 ± 0.108	13.028 ± 0.113	0.680	0.716	0.124	15.0
9.	39.	86.7	23.305 ± 0.165	13.013 ± 0.161	1.030	1.003	0.263	13.9
12.	34.	75.6	23.265 ± 0.219	13.129 ± 0.197	1.275	1.150	0.220	7.7
18.	28.	62.2	23.403 ± 0.304	13.448 ± 0.265	1.609	1.401	0.584	12.7
24.	23.	51.1	23.361 ± 0.384	13.935 ± 0.288	1.842	1.380	0.910	15.0
30.	19.	42.2	23.429 ± 0.502	14.419 ± 0.300	2.186	1.306	1.391	16.2
36.	17.	37.8	23.485 ± 0.609	14.582 ± 0.385	2.511	1.586	1.935	17.1
42.	14.	31.1	22.908 ± 0.527	14.673 ± 0.447	2.346	1.673	1.256	12.9
48.	12.	26.7	22.736 ± 0.746	15.046 ± 0.483	2.584	1.674	1.673	14.1
54.	9.	20.0	22.667 ± 0.907	15.706 ± 0.448	2.722	1.343	0.939	7.2
60.	8.	17.8	21.744 ± 0.383	15.949 ± 0.587	1.084	1.662	-1.782	-56.6
66.	8.	17.8	21.726 ± 0.282	16.411 ± 0.790	0.799	2.234	-1.475	-66.6
72.	6.	13.3	21.813 ± 0.181	17.695 ± 0.340	0.443	0.832	-0.258	-52.7
78.	4.	8.9	21.983 ± 0.303	17.101 ± 0.509	0.606	1.016	0.102	15.5
84.	3.	6.7	22.211 ± 0.271	16.751 ± 0.768	0.469	1.330	0.568	68.8
90.	3.	6.7	22.029 ± 0.494	16.789 ± 0.534	0.856	0.925	0.790	47.1
96.	2.	4.4	22.755 ± 0.320	17.203 ± 0.141	0.452	0.200	0.090	23.9

Table 6.4: Estimated statistics for filtered set of trajectories at mean sea level for Baldwin. July 1982.

SOURCE STATION IS: 2 - ILL BALDWIN PERIOD: 8207 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
3.	56.	100.0	23.499 ± 0.023	13.202 ± 0.017	0.171	0.130	0.009	16.6
6.	56.	100.0	23.588 ± 0.045	13.295 ± 0.036	0.339	0.267	0.034	16.4
9.	56.	100.0	23.653 ± 0.065	13.371 ± 0.052	0.489	0.388	0.072	16.7
12.	56.	100.0	23.717 ± 0.085	13.457 ± 0.067	0.634	0.505	0.122	17.0
18.	56.	100.0	23.855 ± 0.120	13.633 ± 0.096	0.900	0.721	0.256	17.5
24.	56.	100.0	24.002 ± 0.155	13.813 ± 0.122	1.163	0.910	0.430	17.6
30.	54.	96.4	24.225 ± 0.191	14.006 ± 0.149	1.400	1.092	0.659	18.6
36.	52.	92.9	24.389 ± 0.231	14.223 ± 0.175	1.663	1.263	0.984	19.6
42.	50.	89.3	24.626 ± 0.266	14.423 ± 0.197	1.882	1.392	1.216	18.9
48.	48.	85.7	24.807 ± 0.307	14.657 ± 0.218	2.130	1.497	1.480	18.1
54.	47.	83.9	25.042 ± 0.345	14.905 ± 0.240	2.366	1.647	1.768	17.5
60.	43.	76.8	25.088 ± 0.369	15.170 ± 0.275	2.422	1.806	1.837	17.4
66.	39.	69.6	24.960 ± 0.380	15.253 ± 0.304	2.370	1.896	1.684	16.7
72.	34.	60.7	25.038 ± 0.394	15.350 ± 0.334	2.295	1.946	2.265	23.3
78.	32.	57.1	25.054 ± 0.414	15.535 ± 0.356	2.340	2.016	2.187	21.8
84.	28.	50.0	25.334 ± 0.472	15.469 ± 0.360	2.499	1.906	2.394	21.0
90.	25.	44.6	25.122 ± 0.507	15.573 ± 0.394	2.536	1.981	2.472	21.0
96.	23.	41.1	25.548 ± 0.560	15.733 ± 0.448	2.688	2.150	2.855	21.6

Table 6.5: Estimated statistics for filtered set of trajectories at mean sea level for Pennsylvania. January 1982.

SOURCE STATION IS: 3 - PEN CONMJO ALLEG PERIOD: 8201 HEIGHT: SEC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	45.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	45.	100.0	26.280 ± 0.042	13.763 ± 0.063	0.284	0.421	0.000	0.2
6.	45.	100.0	26.315 ± 0.091	13.873 ± 0.129	0.609	0.865	0.038	5.9
9.	45.	100.0	26.276 ± 0.134	13.952 ± 0.188	0.898	1.259	0.140	9.8
12.	45.	100.0	26.210 ± 0.173	13.971 ± 0.231	1.160	1.546	0.219	9.3
18.	43.	95.6	26.192 ± 0.251	14.055 ± 0.286	1.649	1.874	0.643	13.3
24.	37.	82.2	26.068 ± 0.275	14.237 ± 0.339	1.671	2.060	0.844	16.8
30.	34.	75.6	25.995 ± 0.319	14.162 ± 0.370	1.856	2.155	0.965	15.6
36.	26.	57.8	25.881 ± 0.375	14.701 ± 0.416	1.910	2.122	0.468	7.3
42.	24.	53.3	25.999 ± 0.399	14.479 ± 0.469	1.952	2.296	0.784	11.6
48.	20.	44.4	25.772 ± 0.464	14.603 ± 0.391	2.074	1.750	-0.048	-0.6
54.	18.	40.0	25.638 ± 0.473	14.491 ± 0.432	2.005	1.834	-0.396	-5.6
60.	17.	37.8	25.690 ± 0.471	14.615 ± 0.444	1.943	1.829	-1.256	-18.4
66.	15.	33.3	25.071 ± 0.443	14.975 ± 0.407	1.718	1.577	0.737	14.0
72.	14.	31.1	25.476 ± 0.402	14.777 ± 0.548	1.503	2.051	0.991	23.7
78.	13.	28.9	25.751 ± 0.479	14.922 ± 0.612	1.727	2.207	1.041	19.2
84.	12.	26.7	26.098 ± 0.551	14.998 ± 0.759	1.908	2.630	1.246	18.9
90.	10.	22.2	25.683 ± 0.584	14.582 ± 0.816	1.847	2.579	1.450	23.0
96.	8.	17.8	25.962 ± 0.716	14.368 ± 0.998	2.026	2.822	1.136	15.5

Table 6.6: Estimated statistics for filtered trajectories at mean sea level for Pennsylvania. July 1982.

SOURCE STATION IS: 3 - PEN CONMJO ALLEG PERIOD: 8207 HEIGHT: SFC UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
3.	56.	100.0	26.237 ± 0.019	13.671 ± 0.020	0.141	0.148	0.010	26.9
6.	56.	100.0	26.317 ± 0.039	13.695 ± 0.041	0.288	0.307	0.043	27.6
9.	56.	100.0	26.377 ± 0.057	13.721 ± 0.061	0.424	0.454	0.093	27.4
12.	56.	100.0	26.435 ± 0.074	13.754 ± 0.080	0.556	0.600	0.158	27.0
18.	56.	100.0	26.553 ± 0.109	13.822 ± 0.117	0.805	0.878	0.306	25.3
24.	56.	100.0	26.667 ± 0.142	13.894 ± 0.147	1.061	1.101	0.444	21.5
30.	53.	94.6	26.765 ± 0.173	14.006 ± 0.169	1.257	1.222	0.448	15.8
36.	49.	87.5	26.702 ± 0.193	14.083 ± 0.185	1.352	1.296	0.518	15.8
42.	45.	80.4	26.704 ± 0.217	14.188 ± 0.192	1.456	1.289	0.572	15.1
48.	40.	71.4	26.576 ± 0.228	14.217 ± 0.198	1.442	1.251	0.571	15.4
54.	36.	64.3	26.480 ± 0.235	14.242 ± 0.206	1.410	1.236	0.661	18.4
60.	33.	58.9	26.553 ± 0.261	14.338 ± 0.210	1.502	1.207	0.710	17.5
66.	30.	53.6	26.482 ± 0.263	14.325 ± 0.214	1.438	1.175	0.466	12.7
72.	28.	50.0	26.664 ± 0.307	14.571 ± 0.221	1.624	1.167	0.733	15.5
78.	26.	46.4	26.592 ± 0.311	14.567 ± 0.222	1.584	1.131	0.576	12.9
84.	24.	42.9	26.751 ± 0.349	14.800 ± 0.245	1.707	1.202	0.994	18.8
90.	22.	39.3	26.625 ± 0.353	14.814 ± 0.246	1.655	1.154	0.891	18.0
96.	20.	35.7	26.807 ± 0.375	15.049 ± 0.264	1.676	1.182	1.264	24.2

Table 6.7: Estimated statistics for filtered trajectories at 850 mb for Sudbury. January 1982.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 8201 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	45.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
12.	40.	88.9	26.531 ± 0.170	15.944 ± 0.177	1.073	1.117	1.095	43.5
24.	35.	77.8	27.021 ± 0.252	15.856 ± 0.307	1.493	1.816	2.173	44.3
36.	23.	51.1	26.875 ± 0.343	14.900 ± 0.344	1.645	1.651	1.952	35.8
48.	12.	26.7	25.967 ± 0.404	13.553 ± 0.280	1.399	0.971	0.111	3.3
60.	9.	20.0	25.983 ± 0.591	13.537 ± 0.370	2.074	1.110	0.800	10.5
72.	4.	8.9	25.822 ± 0.414	14.222 ± 0.301	0.829	0.602	-0.276	-21.9
84.	3.	6.7	26.509 ± 0.401	14.247 ± 0.493	0.695	0.855	-0.484	-45.0
96.	3.	6.7	27.305 ± 0.575	14.403 ± 0.521	1.169	0.902	-0.923	-34.0

Table 6.8: Estimated statistics for filtered trajectories at 850 mb for Sudbury. July 1982.

SOURCE STATION IS: 1 - ONT SUDBURY PERIOD: 8207 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	25.790 ± 0.0	15.560 ± 0.0	0.0	0.0	0.0	0.0
12.	56.	100.0	26.711 ± 0.081	16.020 ± 0.084	0.609	0.627	0.341	42.6
24.	53.	94.6	27.477 ± 0.122	16.420 ± 0.131	0.889	0.951	0.695	41.3
36.	43.	76.8	27.951 ± 0.163	16.673 ± 0.185	1.071	1.216	1.101	43.8
48.	33.	58.9	28.229 ± 0.220	16.655 ± 0.244	1.265	1.400	1.517	43.5
60.	21.	37.5	28.137 ± 0.330	16.191 ± 0.361	1.513	1.652	2.163	43.4
72.	14.	25.0	27.937 ± 0.501	15.697 ± 0.516	1.876	1.931	3.142	41.7
84.	9.	16.1	27.325 ± 0.696	14.960 ± 0.736	2.087	2.207	4.186	43.9
96.	6.	10.7	26.650 ± 0.665	13.401 ± 0.430	1.629	1.054	1.555	30.4

Table 6.9: Estimated statistics for filtered trajectories at 850 mb for Baldwin. January 1982.

SOURCE STATION IS: 2 - ILL BALDWIN PERIOD: 8201 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	45.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
12.	40.	88.9	24.782 ± 0.179	13.520 ± 0.155	1.135	0.982	0.993	37.6
24.	32.	71.1	26.442 ± 0.237	14.152 ± 0.195	1.339	1.105	0.961	28.2
36.	22.	48.9	27.184 ± 0.324	14.368 ± 0.328	1.520	1.538	1.422	31.6
48.	14.	31.1	27.283 ± 0.467	14.064 ± 0.427	1.749	1.598	1.419	24.9
60.	9.	20.0	26.857 ± 0.538	13.378 ± 0.334	1.915	1.001	0.498	7.7
72.	5.	11.1	25.983 ± 0.726	13.128 ± 0.202	1.624	0.451	-0.640	-13.6
84.	4.	8.9	25.497 ± 0.528	13.077 ± 0.249	1.257	0.498	-0.439	-15.5
96.	3.	6.7	24.986 ± 0.515	13.219 ± 0.390	1.065	0.676	-0.051	-2.6

Table 6.10: Estimated statistics for filtered trajectories at 850 mb for Baldwin. July 1982.

SOURCE STATION IS: 2 - ILL BALDWIN PERIOD: A207 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	23.410 ± 0.0	13.110 ± 0.0	0.0	0.0	0.0	0.0
12.	56.	100.0	23.929 ± 0.094	13.213 ± 0.070	0.705	0.524	0.342	34.5
24.	56.	100.0	24.514 ± 0.172	13.410 ± 0.131	1.290	0.978	1.148	34.6
36.	54.	96.4	25.065 ± 0.217	13.575 ± 0.168	1.592	1.232	1.655	33.1
48.	52.	92.9	25.690 ± 0.250	13.776 ± 0.188	1.800	1.356	1.903	30.4
60.	48.	85.7	26.212 ± 0.265	14.038 ± 0.227	1.834	1.536	2.269	34.0
72.	43.	76.8	26.721 ± 0.285	14.243 ± 0.264	1.869	1.732	2.485	35.4
84.	37.	66.1	27.192 ± 0.296	14.238 ± 0.278	1.799	1.691	2.008	31.8
96.	26.	46.4	27.120 ± 0.354	14.030 ± 0.297	1.827	1.514	1.498	24.0

Table 6.11: Estimated statistics for filtered trajectories at 850 mb for Pennsylvania. January 1982.

SOURCE STATION IS: 3 - PEN COMMJO ALLEG PERIOD: A201 HEIGHT: A50 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	45.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
12.	42.	93.3	26.665 ± 0.177	13.413 ± 0.152	1.148	0.988	0.880	33.7
24.	24.	53.3	26.942 ± 0.329	13.410 ± 0.285	1.612	1.398	1.347	27.4
36.	9.	20.0	26.971 ± 0.522	13.864 ± 0.431	1.566	1.294	1.180	25.7
48.	7.	15.6	27.031 ± 0.580	13.976 ± 0.572	1.534	1.514	0.934	21.6
60.	5.	11.1	26.917 ± 0.564	14.017 ± 0.790	1.260	1.766	0.509	17.8
72.	3.	6.7	26.558 ± 0.799	13.263 ± 0.457	1.385	0.792	-0.274	-8.1
84.	3.	6.7	27.070 ± 0.992	13.389 ± 0.499	1.545	0.864	-1.035	-23.4
96.	2.	4.4	26.518 ± 0.345	14.235 ± 0.082	0.488	0.116	-0.057	-13.4

Table 6.12: Estimated statistics for filtered trajectories at 850 mb for Pennsylvania. July 1982.

SOURCE STATION IS: 3 - PEN COMMJO ALLEG PERIOD: 8207 HEIGHT: 850 UNWEIGHTED

TIME	WEIGHT	% REMAINING	XMEAN	YMEAN	XSIGMA	YSIGMA	COVARIANCE	THETA
0.	56.	100.0	26.160 ± 0.0	13.650 ± 0.0	0.0	0.0	0.0	0.0
12.	56.	100.0	26.746 ± 0.083	13.891 ± 0.051	0.625	0.379	0.196	26.6
24.	53.	94.6	27.260 ± 0.161	14.015 ± 0.101	1.170	0.732	0.647	25.3
36.	44.	78.6	27.383 ± 0.199	13.876 ± 0.126	1.322	0.838	0.578	18.3
48.	36.	64.3	27.414 ± 0.213	13.824 ± 0.167	1.275	1.003	0.498	17.0
60.	29.	51.8	27.530 ± 0.229	13.837 ± 0.216	1.235	1.163	0.357	13.2
72.	23.	41.1	27.369 ± 0.237	14.044 ± 0.275	1.135	1.319	0.746	30.1
84.	22.	39.3	27.540 ± 0.270	14.169 ± 0.322	1.267	1.511	1.085	34.0
96.	19.	33.9	27.726 ± 0.301	14.222 ± 0.362	1.311	1.580	0.906	27.8

Figure 6.1: Means of the trajectory points at mean sea level for Sudbury. January 1982.

Figure 6.2: Means of the trajectory points at 850 mb for Sudbury. January 1982.

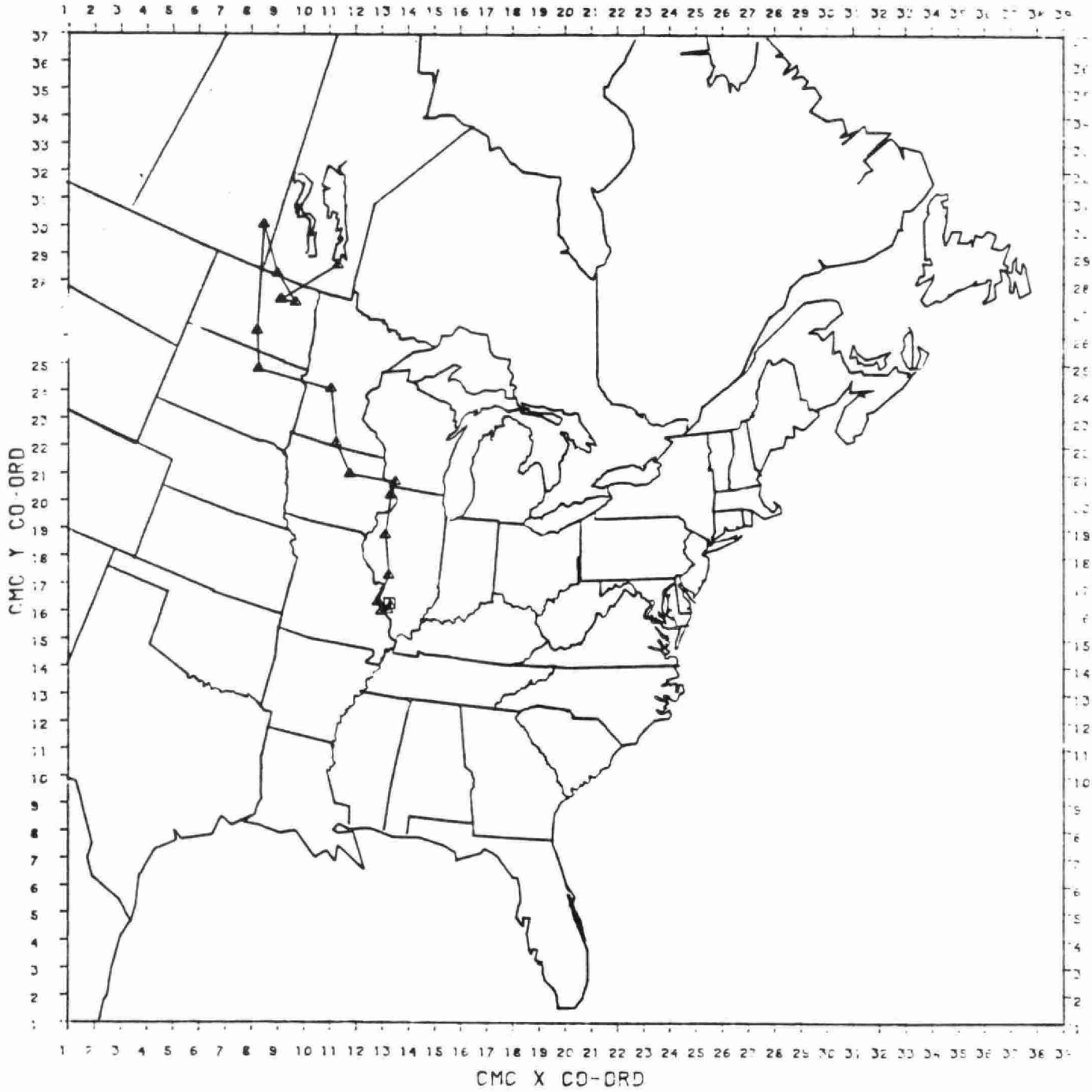


Figure 6.3: Means of the trajectory points at mean sea level for Baldwin. January 1982.

Figure 6.4: Means of the trajectory points at 850 mb for Baldwin.

January 1982.

Figure 6.5: Means of the trajectory points at mean sea level for Sudbury. July 1982.

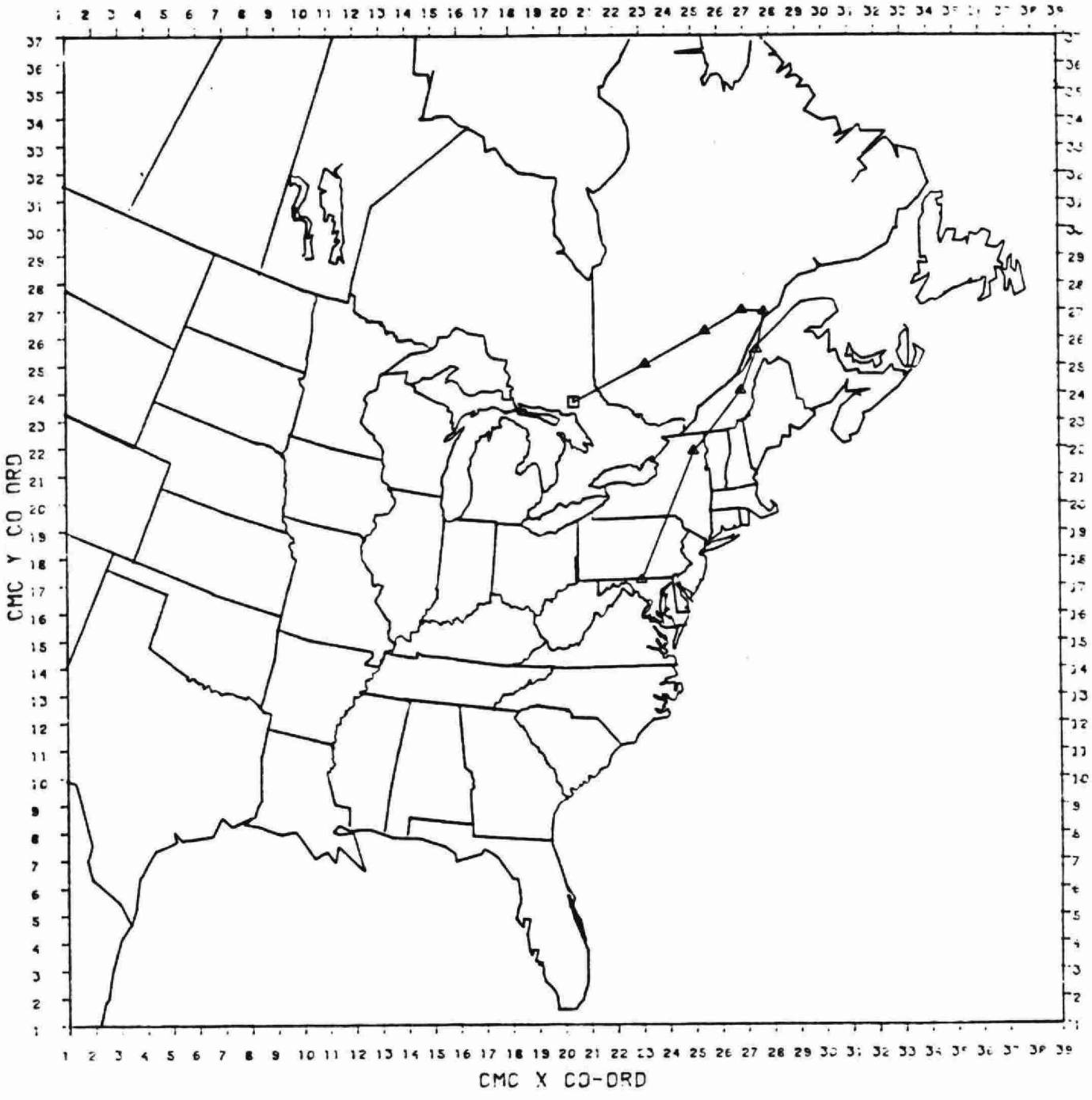


Figure 6.6: Means of the trajectory points at 850 mb for Sudbury. July 1982.

Figure 6.7: Means of the trajectory points at mean sea level for Baldwin. July 1982.

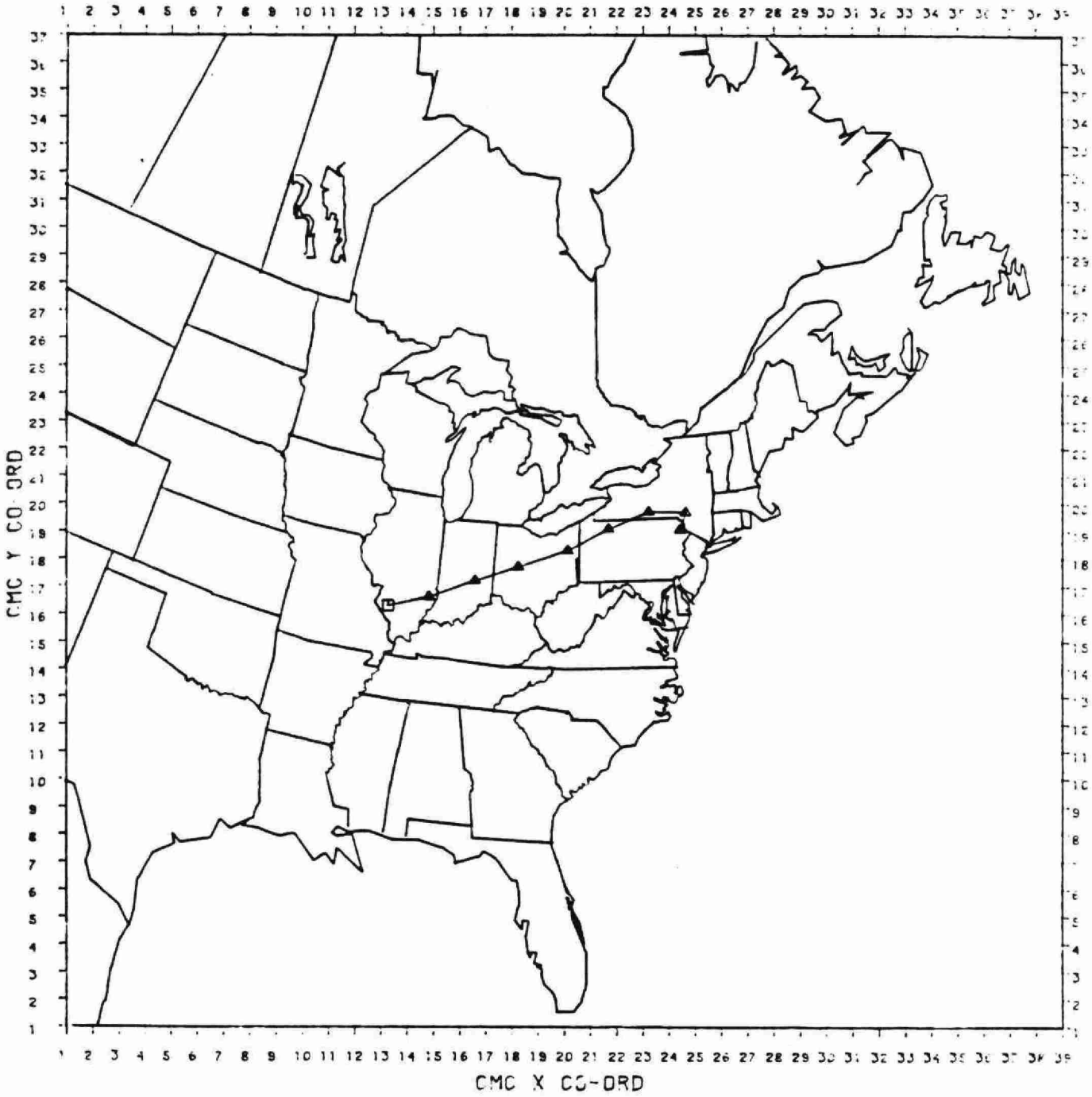


Figure 6.8: Means of the trajectory points at 850 mb for Baldwin. July 1982.

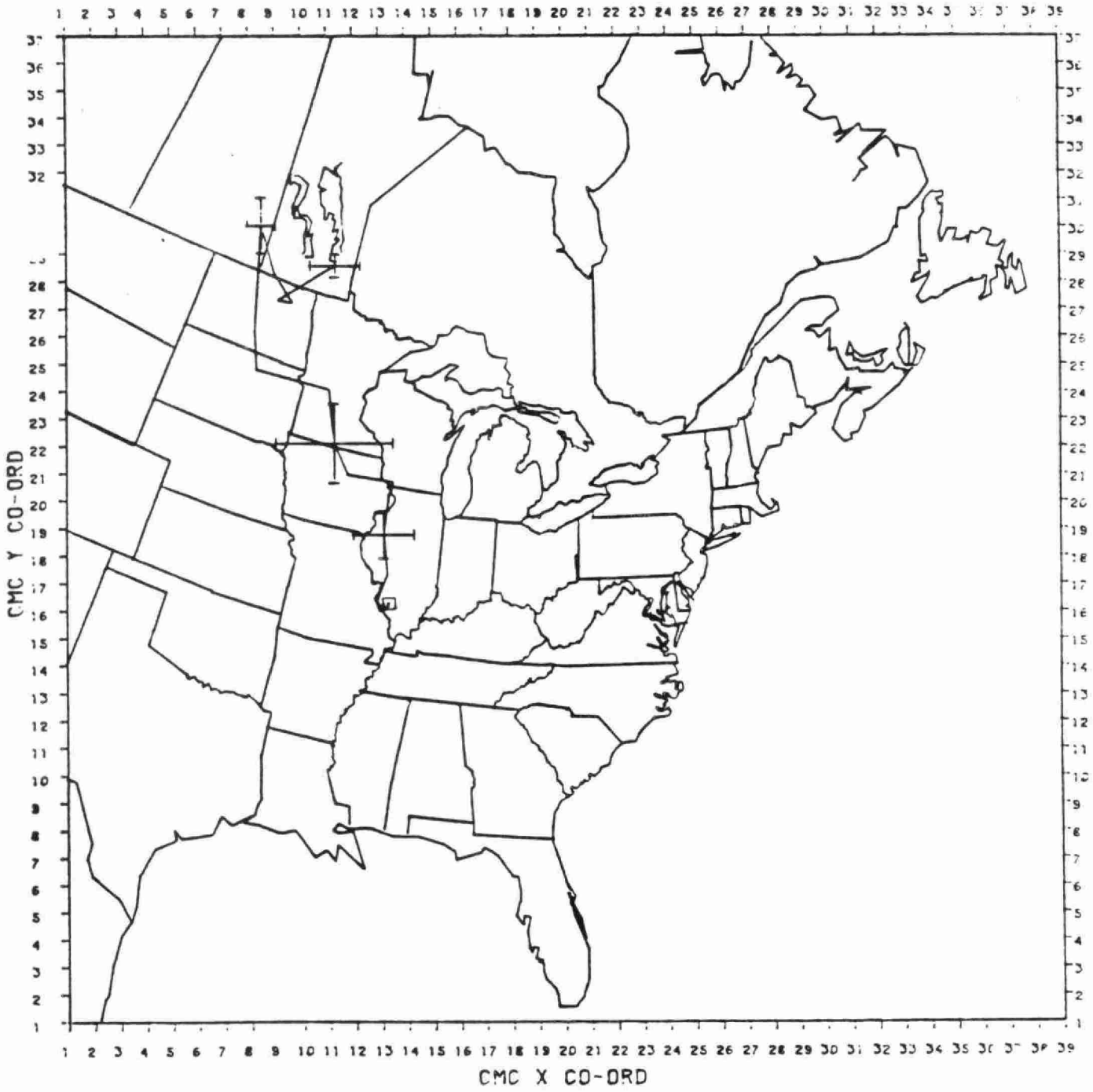


Figure 6.9: Mean trajectories with standard errors for Baldwin at mean sea level. January 1982.

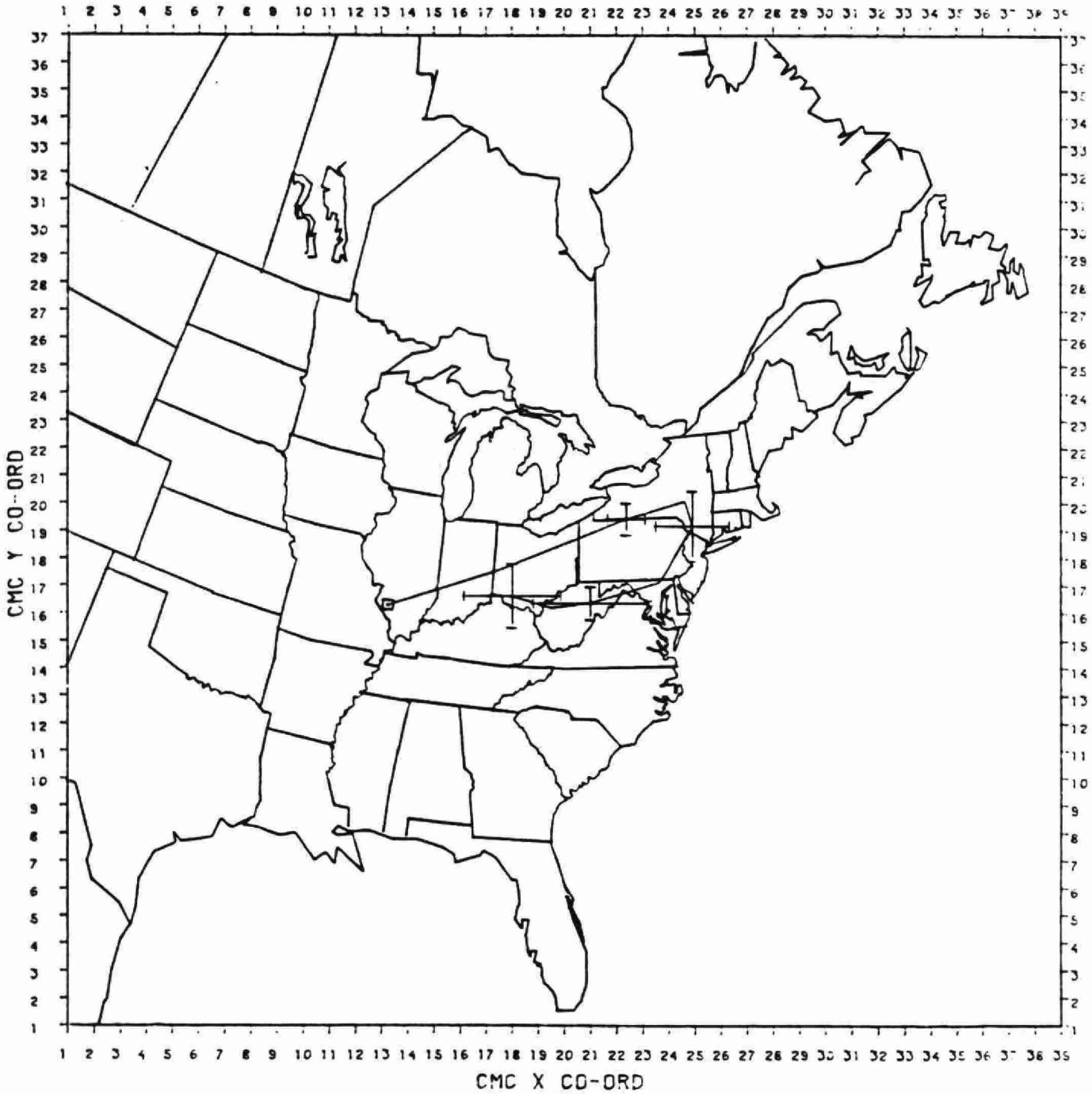


Figure 6.10: Mean trajectories with standard errors for Baldwin at 850 mb. January 1982.

Figure 6.11: Mean trajectories with standard errors for Baldwin at mean sea level. July 1982.

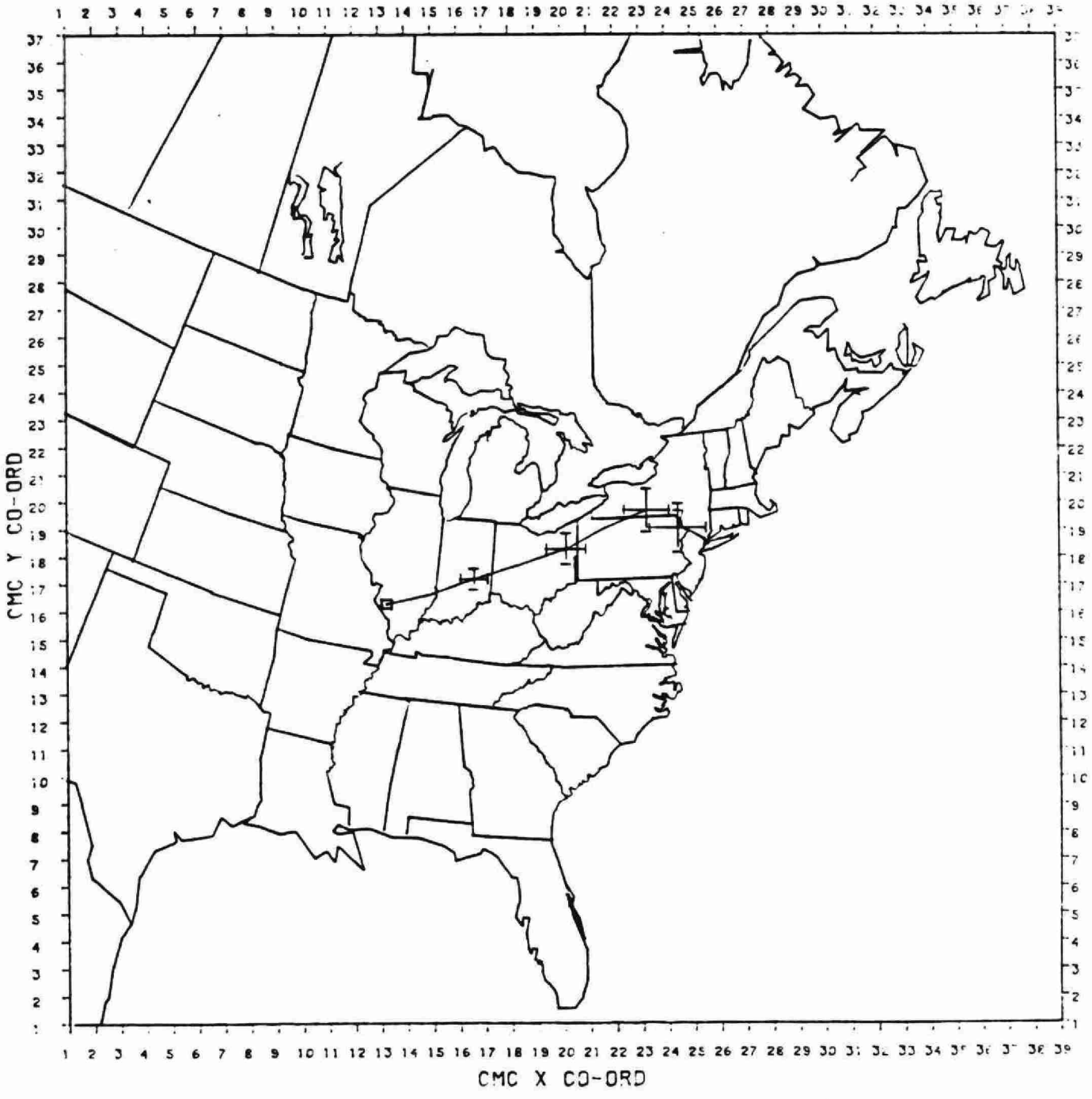


Figure 6.12: Mean trajectories with standard errors for Baldwin at 850 mb. July 1982.

7. References for the ADDENDUM

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